School Shop

vol. XX no. 10

JUNE 1961

Design and Industrial Arts
by Delmar W. Olson

Bongo Drums
by Paul W. Oliver

The Impossible Square
by Ernest C. Carlson

Cover Story: The school year's end is at hand, and summer's leisure — for some, at least — is near. To those of you who are going back to school, we extend our best wishes. To those of you who are going to work another job, we extend our sympathy, because work is work. But to those few of you who are just going to vacation you have our envy. See you in the Fall.

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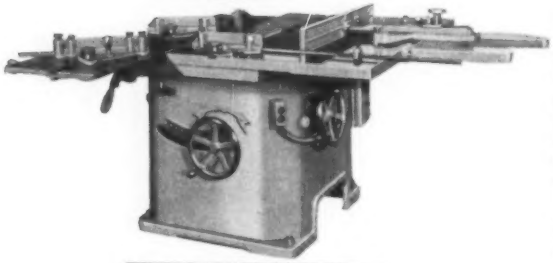

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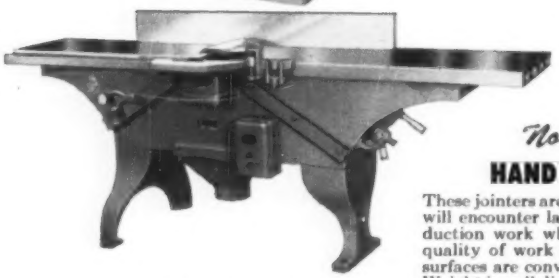

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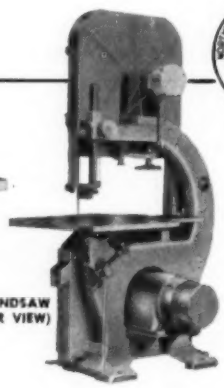

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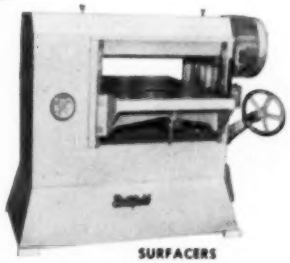

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School Shop TALK

COMMENTS ON ISSUES FACING INDUSTRIAL EDUCATION

The Time Has Come to Talk

Messrs. Karnes and London proposed in these columns a few months ago that a committee be named by the American Industrial Arts Association and the American Vocational Association to discuss ways and means of effecting a consolidation of the AIAA and the industrial-arts division of the AVA. They further suggested that one of the first moves of an amalgamated industrial-arts group might be to hold a joint convention.

These proposals have met with forthright responses from coast to coast, many of which have been printed in the "Mail" columns in SCHOOL SHOP. In addition, there was much informal discussion of the idea at the AIAA convention in St. Louis. Some readers misinterpreted the proposal in one way or another while others read into it more than the writers intended.

By and large, the majority of those whose opinions we have received or have heard believe that something should be done about unifying the industrial-arts groups. Let's look for a moment at the arguments most frequently mentioned for amalgamation:

1. There would be but one membership fee.

2. Organizational activities by members and leaders would be confined to one group.

3. One convention would be less expensive to both members and exhibitors in terms of both time and money.

4. A single stronger organization could provide more services for the members of the profession.

5. All industrial-arts people would be under one roof.

6. Industrial arts could present a united front to the public and to the rest of the educational profession.

7. Probably a higher percentage of industrial-arts teachers would join a single national association than now belong if more services and more professional leadership were provided by a stronger national organization.

Now let's look at the opposite side of the coin. Here are some of the objections to changing the status quo:

1. Industrial arts is closely tied to trade and industrial education because of its prevocational and even vocational nature.

2. Many industrial-arts leaders in supervision and teacher training and many teachers have responsibilities in both industrial arts and trade education.

3. The AVA can provide strong legislative help in getting Congressional action on federal support for industrial-arts education.

4. Competition between professional groups can lead to healthy growth and development of both.

5. Two conventions in different parts of the country each year give people greater opportunity to attend conventions because one is usually closer.

6. Lack of convention income or diminution in such income as well as loss of membership income would work a hardship on one or the other association.

Many of our readers will no doubt have other arguments to add to the foregoing lists of pro and con points.

A careful appraisal of the arguments on both sides leads us to the conclusion that the time has come to follow the suggestion of Messrs. Karnes and London to set up committees from each of the organizations to sit down and explore the matter further. We have noted with dismay what happens when professional interests are splintered such as is true in the business-education field. There are men of good will in each organization who can be trusted to examine the problems objectively and make suggestions for a unification program that would be professionally desirable. If need be, an outside consultant group of experienced people in administration could be hired to study the problem and offer solutions.

Action should be taken now. The American Industrial Arts Association and the American Vocational Association owe it to the profession to take a statesman-like view and provide concerted leadership for a segment of education which is far behind most subject-matter areas in national stature. There are problems but they are not insoluble. Let's get at the matter at hand. — *L.W.P.*

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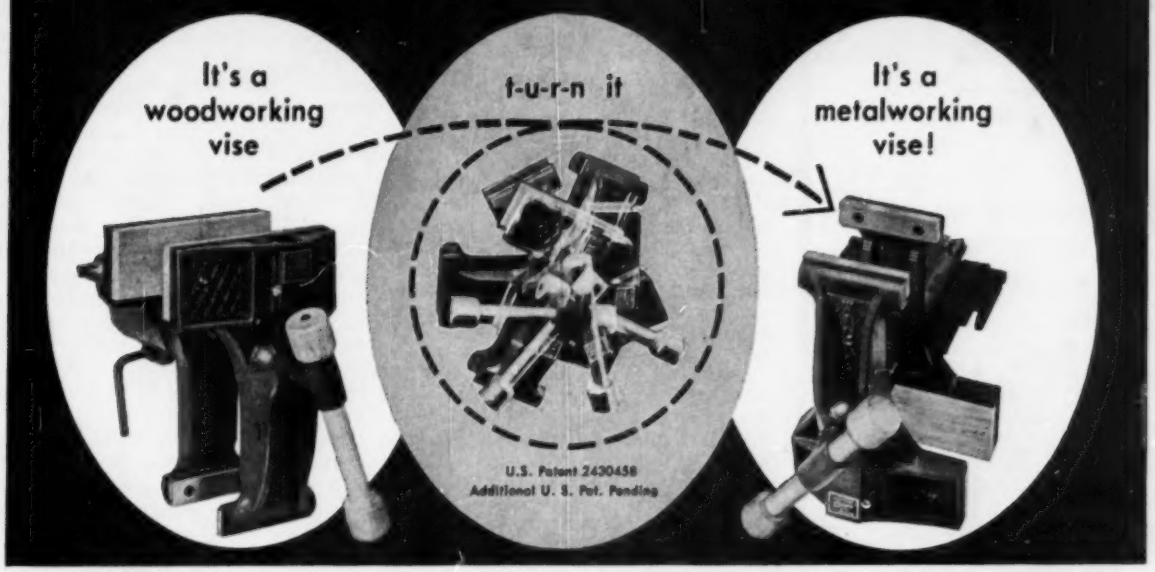

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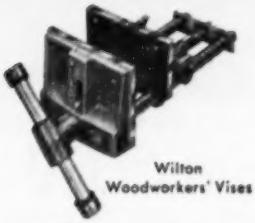

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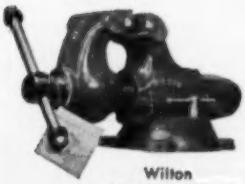

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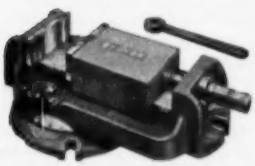

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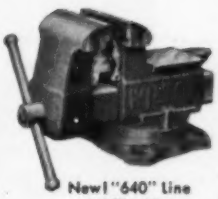

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IN THE MORNING MAIL...

(Brief comments about SCHOOL SHOP and the field it serves are invited. Address the Editor, SCHOOL SHOP, Ann Arbor, Michigan.

More about the "Proposal."

Dear Sir,

The proposed "One Organization for Industrial Arts," set forth by Dr. London and Dr. Karnes in the February issue of SCHOOL SHOP magazine, is truly noteworthy. The immediate past president of the American Vocational Association, Mr. E. M. Claude, suggests that a first step in setting up such a united organization is a joint convention for the Industrial Arts Division of the American Vocational Association and for the American Industrial Arts Association.

However, Dr. Ivan Hostetler (then president of the AIAA) writes in a letter in the same issue: "While I would have no objection to a committee representing both groups to study the problem, I do not see that much could be gained by such a study." I interpret this statement, together with the balance of Dr. Hostetler's letter, to mean that the AIAA is not interested in investigating the possibility of holding a dual convention.

Officers of the Industrial Arts Division of the American Vocational Association are ready and willing to meet at any time with representatives of the AIAA to explore the possibilities of such a convention. However, we also believe that it is impossible to hold such a meeting until that organization is willing to participate.

The Industrial Arts Division of the American Vocational Association offers assistance to *all* industrial-arts teachers and wishes to call to their attention available material that may be of help to them.

Improving Instruction in Industrial Arts and *Industrial Arts in Education* are two brochures which are of value to teachers developing instructional material. These publications may be secured, at cost, by writing: The American Vocational Association, 1010 Vermont Ave., N.W., Washington 5, D.C.

The film *Knowledge and Skills*, produced by the Sears-Roebuck Foundation in cooperation with the AVA, is also available and is obtainable through Modern Talking Picture Service, 3 East 54th St., New York 22, N.Y. Prints of this film may be borrowed without charge, except for cost of mailing.

The Industrial Arts Division of the American Vocational Association extends to all industrial-arts teachers a most cordial invitation to join this organization, which has developed material of immediate value to all persons interested in industrial-arts education.

John A. Jarvis,
Vice-president, Industrial Arts Education, AVA.
Dean, School of Industrial Education, Stout State College, Menomonie, Wis.

Dear Sir,

I was very pleased indeed to notice the very fine editorial in your February issue of SCHOOL SHOP regarding the American Industrial Arts Association and the Industrial Arts Division of the American Vocational Association.

I would say that Mr. London of the University of Missouri and Mr. Karnes of the University of Illinois deserve a great deal of credit for tackling this particular problem. I personally have to admit that I am in accord with everything in question in this editorial as I believe it would work out for the benefit of a great many new administrators and teachers in the field. I should like also to say that several exhibitor friends of mine have expressed their desire that something be done along these lines. I really believe this is worthwhile and I would say that the time is definitely right to organize a committee representing the AIAA and the Industrial Arts Division of the AVA to get together and discuss plans for amalgamating these two organizations into one. I am sure this would greatly benefit a great many industrial-arts teachers who now do not belong to either one of the organizations. If these associations were amalgamated into one strong association, I am sure much progress would be made in enrolling many more teachers in this particular field. I, therefore, hope that AIAA and AVA can work out this problem as I think the AIAA can serve its members much better in the work they do if they were a division of the AVA.

I agree that these problems deserve consideration by a group of broadminded leaders in the field and I hope this may soon be brought about; and also that it will be possible to hold a joint convention.

H. E. Masters,
Educational Director,
The L. S. Starrett Company,
Athol, Mass.

Dear Sir:

The letter entitled "A Noteworthy Proposal" in the February issue of SCHOOL SHOP interests me very much. Karnes and London are certainly on the right track, even though what they are saying has been talked about before. In fact, some years ago a committee from each of the associations met to discuss the possibility of some kind of merger. I was a member of that committee and am sorry to say that no earth shaking developments resulted.

One of the difficulties that faces us is the overlapping of members. My guess is that most of those that are members of the AIAA are also members of the AVA and its industrial-arts section. Just what would be gained from a merger is questionable, if my premise is correct. If everyone who is now a member of the AVA would terminate this membership, we still would probably gain nothing in numbers even though we would, perhaps, gain in solidarity and a unified purpose. That may be what these two men have in mind.

The AVA has been good to the industrial-arts section, even though sometimes I feel that industrial-arts people do not belong in an association whose principal concern is vocational education. This has been the complaint over the past 32 years—the length of time that I have been a member. . . .

Stanley J. Pawelek
Supervisor, Industrial Arts,
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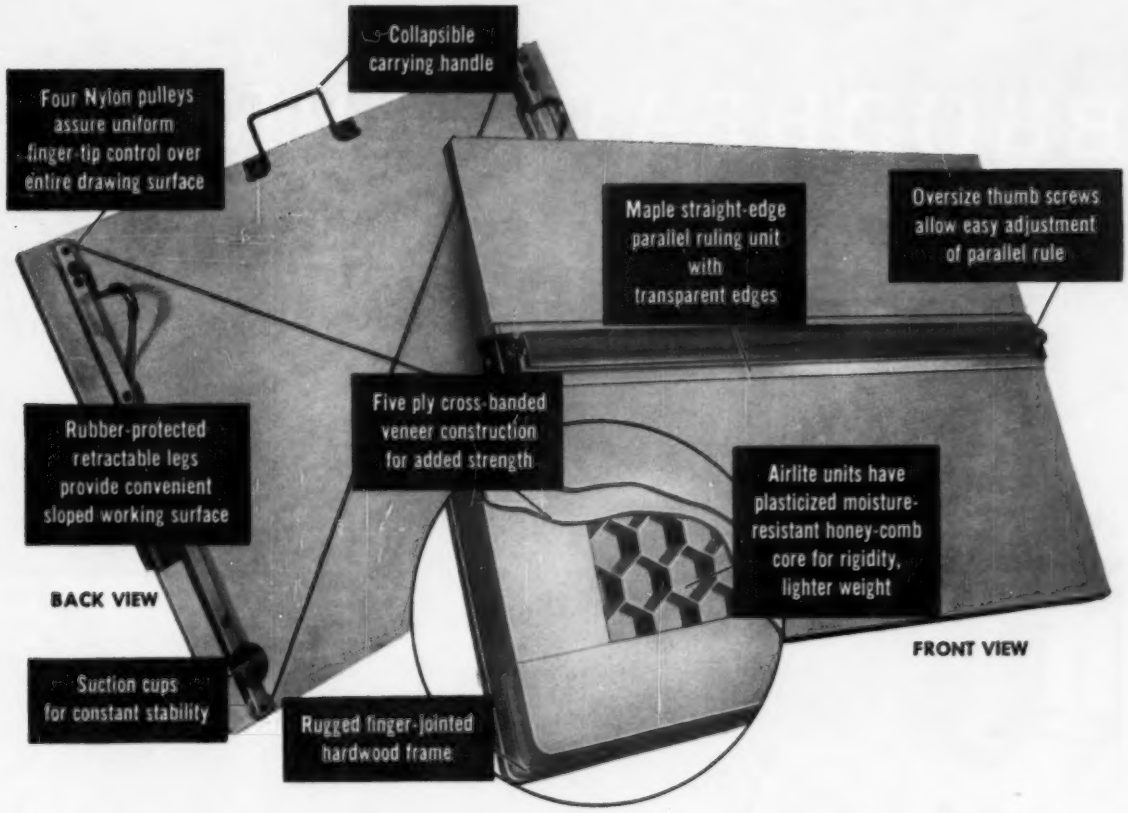
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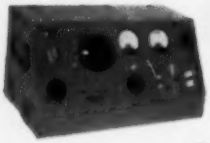

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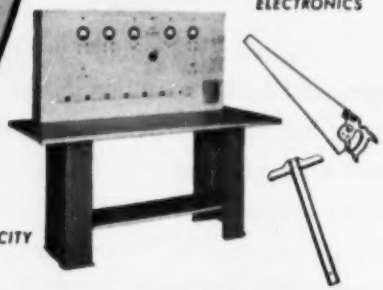

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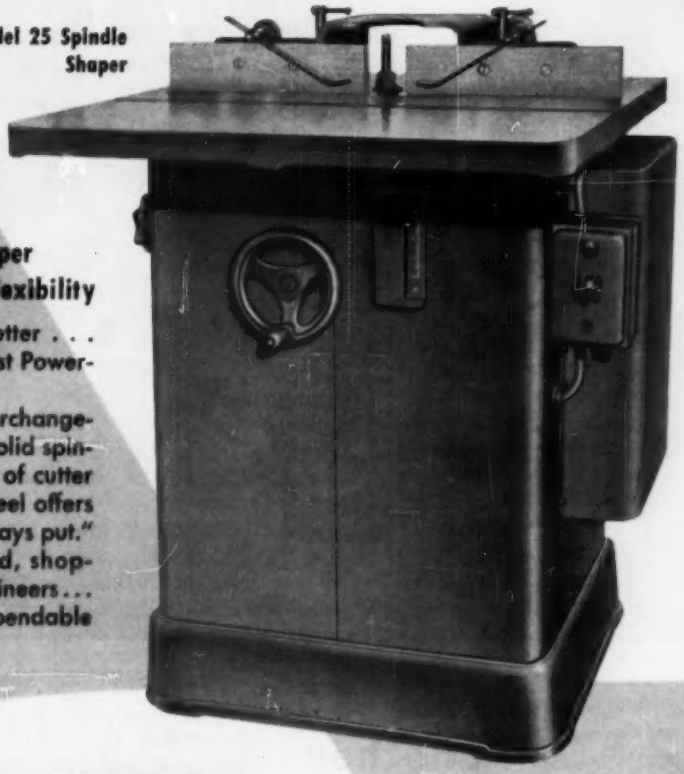

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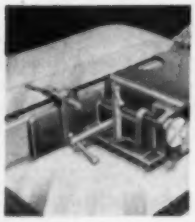

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Another look at

Design and Industrial Arts

By Delmar W. Olson

Professor of Industrial Arts, Kent, Ohio, State University

WHO is the tastemaker in industrial arts?

If we could find him, perhaps we could learn what is good design. He could teach us—as industrial-arts teachers—and then we could teach our students, and finally, we could all rest easy because we would all be right. Needless to say, it is not as simple as all that.

If we will design, we must think. If we will improve design we must improve our thinking, and we in industrial-arts design usually stop thinking too soon.

Design in industrial arts suggests many questions. For example, is planning, as we see it with the project, the equivalent of designing? It is commonly assumed so. Is reproducing and copying, at which we are masters, an experience equivalent to designing? It must be because it is a standard practice. Is concern for the esthetic aspect of the project the essence of design? It must be because apologies for design in our projects are generally offered in response to criticisms of the lack of beauty in them. Must one have a background in art before he can produce good design? We secretly think so, but we do not openly admit it. Must one have a background in fundamentals of materials and tools before he can design? Apparently we believe so because beginners in our classes regularly make teacher-planned articles.

When does one become mature enough to design the projects he makes? In much of industrial arts he never reaches maturity; even on the collegiate level he is presumed to be too immature. I have some other answers to these questions and I would like to share them with you.

Man by Nature Is a Designer

Man is born with the potential for solving problems, for creating, and for inventing. He has a brain with which to conceive and hands with which to do. With these he was placed in a world of materials and energies, and his Maker expects a reaction and an interaction. He intends that man use and strengthen his natural facilities in the utilization of the materials and energies. This I believe.

I believe, too, that design has moral and spiritual values. And, for this reason—a strong foundation on which to build a concept of design—I do not feel I have to find the tastemaker. From this foundation I can see industrial arts in its purest and simplest form as merely the means of bringing the human being, with all of his talents, into an environment of materials, tools, machines, products, and processes for purposes of interaction, ultimately culminating in the fullest development of capabilities that will enable him to find purpose and direction for his efforts. The fullest development of the individual accompanies the fullest development of his expression with materials.

The Technology: Man and Materials

Man and materials make the technology. Technology is the record of man's achievement in materials. It began when he first discovered that he could extend his power and increase his authority by using something beyond himself. A stone or a club in his hand lifted him above the animal because he now could more effectively subdue the animal.

Technology is also the record of man's control over nature. When he first learned to ride a floating log, he extended his horizons. When he hollowed the log, he increased its transportation possibilities. When he built a ship, he was lured into the open seas. When he devised the magnetic compass, he was able to sail to where he chose and with the assurance that he could find his way back. The damming of a stream led to flood control and subsequently to hydroelectric power, which increased even further, his control over nature.

Technology is the record of man's ability to create his own environment. With it he has built cities, outsped the fastest bird, placed lakes where he chose, planted forests where he wanted them, and burrowed miles into earth, and even, as the Dutch have done, built a country out of the sea.

Technology is the record of man's release from enslavement. He has learned to communicate by written language, the printed word, by radio, telephone, and television. Lower levels of drudgery have disappeared with the advance of automation. Now man is becoming enslaved by his leisure. Technology seeks to release him here as it provides means for making good use of his free time.

Technology is the record of man's material concern for freedom. Technology today provides work and income for the vast majority of Americans and in this capacity provides a freedom from want. It furnishes medical materials and facilities to free him from many fears. It equips his police, fire, and military services for his security. Freedom of speech, religion, and congregation would be less effective were it not for graphic arts, transportation, and electronic communications provided by the technology.

Technology is the record of man's progress in the fulfillment of his destiny. All of the avenues of technological progress point to his material achievements for the uplift of his fellow men. They indicate the extent to which he fulfills his obligation to himself and to his Maker—developing those native talents for creating, for problem-solving, for constructing with materials. Technology, then, is greater than things technical; more than technics. It is concern for man by men. It is reverence for the Master Creator.

It is man doing with his life what he is intended to do.

Design: What Is It?

The preceding interpretation of technology is expressive of origins and content of a philosophy of design. While this concept may be as broad and as deep as the technology, it is simple, logical, and to the point. Design is the process by which man finds and develops uses for materials. Design is the process through which man makes materials serve man. Design is the humanizing of materials. It involves men and their natural talents for reasoning, problem solving, and constructing with materials provided by nature. It permits him to express his concerns for love, beauty, peace, goodness.

When design is thus considered as the creator of the technology, the facets of its role become apparent. Design is first of all problem solving. Design becomes thinking because thinking begins with a problem. Whether the problem is simple or complex, its solution still has to result from thinking. At this point, design becomes imagining, ideating to conceive solutions. One idea suggests another in the process of ideation.

The search for a better solution is now underway and design becomes that search. Perfection in the solution is relative to time, resources, and the designer. A design is perfect only for the immediate. Tomorrow it can be improved.

Design at this stage points to the discovery of a better way. But one discovery reveals another until the limits of time, intellect, and resources are reached. Design then leads to creating, to originating in the search for a better way.

Design now becomes engineering, the science of constructing. Here the idea — the solution, if you will — is translated into proposals of materials, structures, processes, and costs. This leads to the development of the solution where design takes on actual dimensions.

As this search for the better proceeds, design becomes refining of the solution with an elimination of weaknesses.

Design and Industrial Arts

The concept of design that has been developed can be termed a "design approach to problem solving." Applied to industrial arts, this concept can serve as a design approach to industrial arts. Through the years when design has been applied to industrial arts, its emphasis has been largely on improving the esthetic aspect of the project. Criticisms by art people, to which industrial-arts teachers have been particularly sensitive, were centered in a concern for beauty. At the moment, design-conscious, industrial-arts teachers are directing their students to the so-called contemporary style, and seemingly they are finding some sense of security there. But design education here is not the process of loading students on a bandwagon in a style parade.

If we will accept the proposal of the design approach to industrial arts, the relationship of design and industrial arts is one of basics and fundamentals. It suggests a completeness, an integration, and an actual educative maturity for industrial arts. This design approach puts emphasis on the growth and development of the whole individual and in the directions which that growth and development should rightly take. It requires the complete involvement of the individual as the means to his greatest growth and development.

The design approach to industrial arts puts faith in the intelligence and the natural aptitudes of the individual. It makes him responsible for finding a better way. Teacher-planned projects are not consistent with the design approach. These presume faith only in the intelligence of the teacher. This is in strong contrast to the spirit of the design approach.

The design approach to industrial arts puts emphasis on individualization through independent study in the search for unique solutions. Furthermore, the design approach makes the program one of research and development. The teacher is involved in this as fully as the student, but for the purpose of promoting the maximum growth and development of the student.

Assurance of timeliness, a continuing newness, and continuing growth and development are other aspects of the proposed approach. Only the goals remain constant. The methods of reaching the goals are all that can change.

Educative responsibility is assured in the new approach toward industrial arts. Such a program not only will make good sense to the superior industrial-arts teacher, but it will also attract the attention and respect of academic colleagues as nothing else has. Industrial arts will have a natural appeal for the superior student. Even the average and less-able student will achieve a level of growth and development far beyond that ordinarily assigned to him. And, now industrial arts can become essential to the all-round education of every boy and girl.

Design and the Industrial-Arts Teacher

Industrial-arts people are forever seeking short cuts. But there are no short cuts to good design any more than there are short cuts to the development of a philosophy of living. The design approach to industrial arts places the teacher in a new and greater role. He is now the resource leader.

The student uses him as consultant, adviser, and resource person. The teacher now finds himself surrounded by intelligence at work. His major responsibility is centered about inspiring his students to draw on intelligence to an even greater degree and to stimulate them to seek even better ways. The design approach has the student thinking beyond the lesson and searching beyond the laboratory. The technical competence of the teacher is no longer the measure of the achievement of the student. The teacher, if his students are to be creative, will have to teach creatively. If his students will continue to search for better ways, he must continue to search for better ways of teaching to keep them searching.

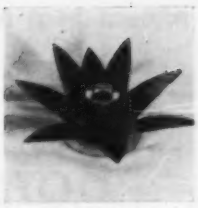
What Is Good Design in Industrial Arts?

Good design in this technological concept has its basis in philosophy rather than in form, color, and texture. Design for industrial arts is a complexity that involves, first of all, a concern for the growth and development of the student. There is the concern through the student with what he does with materials because what he does to them is a strong measure of what they do to him. Design for industrial arts, then, is more than an application of the processes of industrial design in the sense that in metals or woods or clay, for example, we draw on the basic processes of the respective industries.

Good design is good solutions to problems which in industrial arts are both technical and human. Because

(*Continued on page* 38)

Ideal for the small shop



Candle Holder

By William R. Biggam
Industrial-Arts Department, University of Idaho, Moscow

LACK of funds and material very often are the bane of existence for instructors in a small general shop. He is restricted; his "style" is cramped. This candle holder, however, is a partial, yet hopeful, solution to this problem.

The student learns to use basic handtools found in most small comprehensive general shops: a compass, pencil, universal snips, file, abrasive paper, soldering iron, hack saw, hand seamer, drill and bit, wood-turning lathe and turning tools, and the band saw or jig saw.

The materials the student will work with are few and inexpensive. They are: a piece of light-gage sheetmetal or a used one-gallon rectangular antifreeze can, 9" x 19"; a ½" x 4" square piece of hardwood; a 1½" length of ¾" soft-wall conduit; solder and flux; drawing paper; rubber cement; finishing materials; and felt cloth or felt paper.

Following are procedural hints:

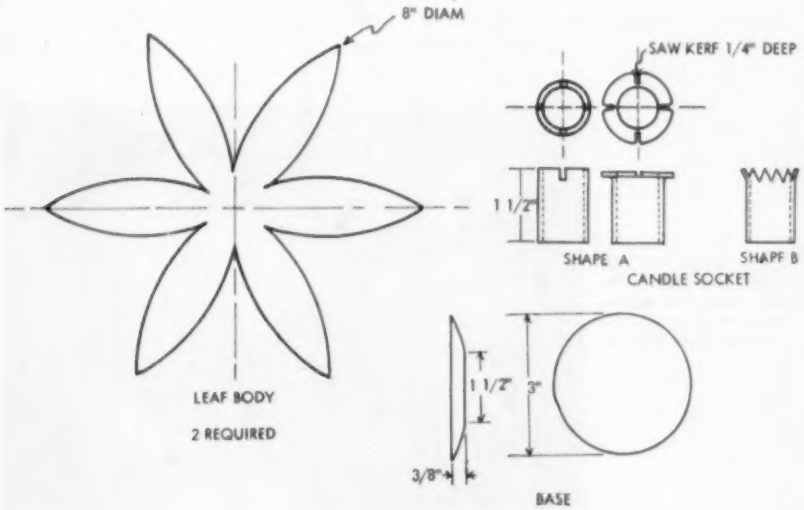
Leaf body.—Lay out and cut the leaf bodies. This pattern can be laid out on drawing paper, cut out, and then rubber cemented to the metal. Each holder requires two pieces. They can be of the same size, or they can vary somewhat with the inside leaf body being slightly smaller than the exterior. File and smooth the rough edges of the leaf. Bend each leaf lengthwise down the middle with a hand seamer. The amount of bend can vary to suit individual tastes.

Next, bend the leaves upward to their inclined position with the inside leaves inclined at a somewhat greater angle than the outside leaves. This operation can be done by placing a short piece of 1½" round wood stock in the center of the leaf body and breaking each leaf into position. The two pieces are then sweat soldered together.

Candle socket.—This part is made from a 1½" length of ¾" soft-wall conduit.

The shape and design can vary. It can be filed flat across and allowed to remain straight, which is not unattractive. Shape "A" in the drawing is a design made by sawing ¼" deep cuts in the top of the conduit in quarters. The edges can then be bent to a right angle and the corners rounded.

Shape "B" is a little different. This is done by filing a series of cuts around the top of the socket with a slim, tapered, triangular file. The pattern can best be determined by laying out a stretch pattern in equal length to the circumference of the conduit, marking out the cuts, and then cementing the pattern to the conduit and filing accordingly. After the filing has been done, the points can be flared out slightly with a pair of pliers. Care should be exercised not to bend too fast or too hard. The socket is then sweat soldered to the leaf bodies.



The body and socket, assembled, can be finished in several ways. The entire surface can be painted with flat black enamel. An alternate method, somewhat more attractive but a bit more time consuming, is to mask out the leaf bodies and spray the socket with several coats of fast-drying brass enamel or lacquer. The leaf bodies can then be painted a flat black. Because the leaves are made from light-gage metal, they can easily be bent upward slightly to permit ease in application of paint to all parts of the body. Once dry, they can then be bent back into position.

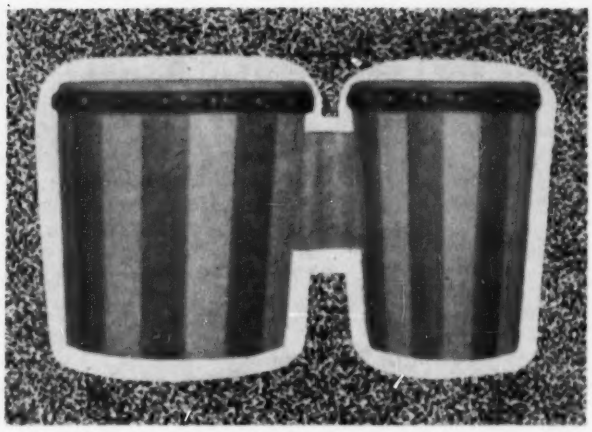
Base.—The base can be turned from any available hardwood. Oak and maple, with a blond finish, and mahogany and walnut, finished natural, have been found very attractive.

The base stock, reduced to ½" thick and cut to a diameter of 3½", is glued to scrap stock with a piece of light paper intervening, then mounted on a face plate, turned to size and shape, and finished.

The entire project is assembled by fastening the upper assembly (leafs and socket) to the base with a #5, ⅜" round-head, blued screw. A flock finish or a piece of felt cloth or felt paper can then be applied to the bottom of the base to protect any surface on which the holder will be placed. ★

A neat beat for your boys

Bongo Drums



By Paul W. Oliver
United Township High School, East Moline, Illinois

A student disc sanding the exterior of a drum.

IF any of your students are musically inclined or enjoy Latin rhythms, here is a tailor-made project for them. The project not only gets the interest of your shop students, but once the word gets around and a good pair of bongo drums is put on display, then your shop program will be of interest to the entire student body. With a little planning, and a jig to cut the segments for the drums, the bongos are easy to make.

Bongos can be purchased in a variety of sizes so the size is not too important. What is important, though, are: the two different tones and the pleasing proportions of the pair of drums.

The number of segments that make up each half of a drum can vary. Here again you need to work toward achieving proportions of each segment of the drum and to have an even number of each segment to have consistently contrasting colors of pieces of wood.

Using the dimensions from the drawing, a simple jig can be made to cut the segments. For the best results, the segments should be ripped on the circular saw, using a hollow-ground, fancy, combination blade. This makes a cut that is smooth enough for gluing.

Applying the glue and the clamps should be done as quickly as possible. Rubber bands cut from inner tubes make good clamps. These may need to be doubled for the proper tension. Excess glue should be washed off.

Smoothing the bongos can be done on the disc sander, or a hand plane can be used to rough off the flat spots, followed by hand sanding. A small radius should be put on the outside top where the skins stretch over the corner. The inside of the bongos need not be sanded, but by doing this seemingly unnecessary work the student should be prouder of his finished project. This inside sanding can easily be done by making a tapered sanding cone and using it with the wood lathe.

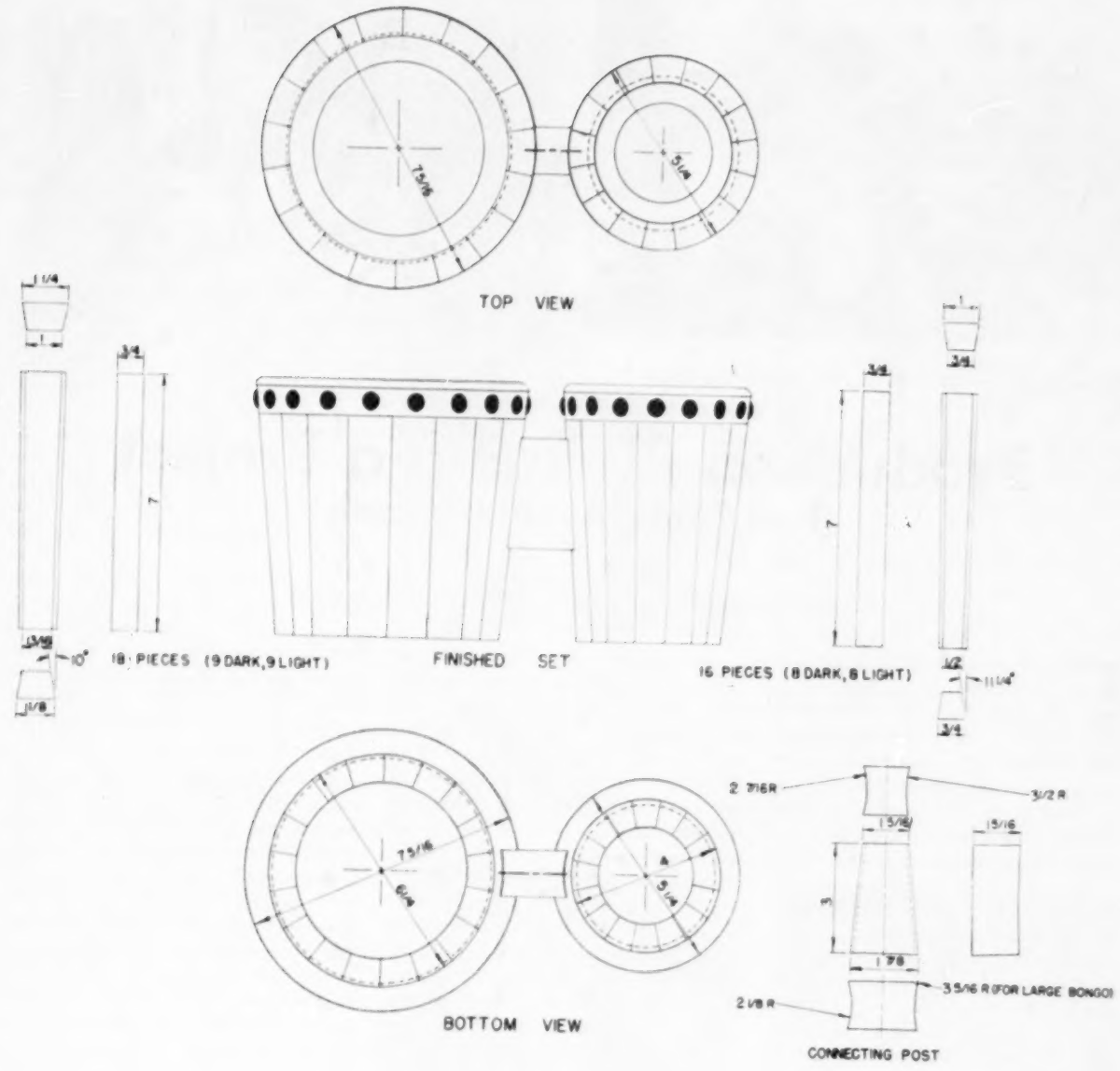
This method of construction can be used for making bongo drums, but with the addition of a groove near the bottom of the segments and a bottom piece of some sort, it can also be a bucket, a waste basket, or a flower pot.

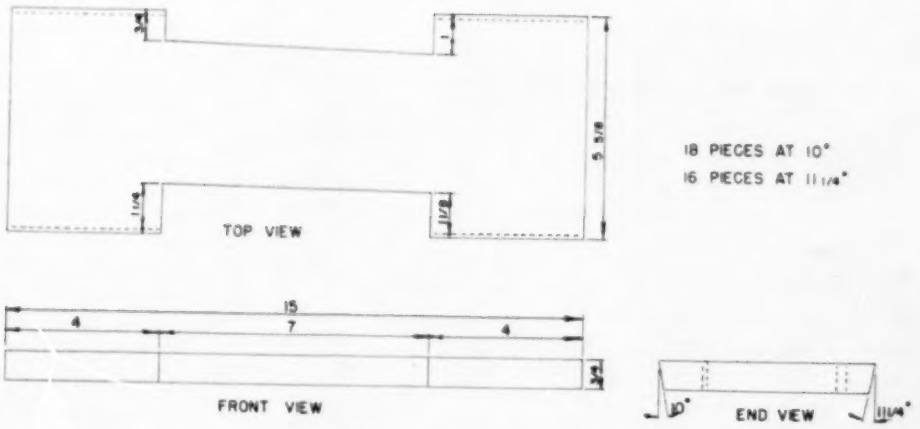
The spacer between the bongos should be made next. It should be made to fit quite accurately because only one bolt is used to fasten the pair of drums together. All holes should be bored for the bolt, and finishing should be completed before the skins are attached.

Bongo heads are made of goat skin and can be purchased or ordered through a music store. A skin should be thoroughly soaked in water before it is fixed to a drum. It should be stretched slightly by hand as it is nailed in place. Three-eighths inch carpet tacks can be used for this tacking. They should be spaced about ½" apart.

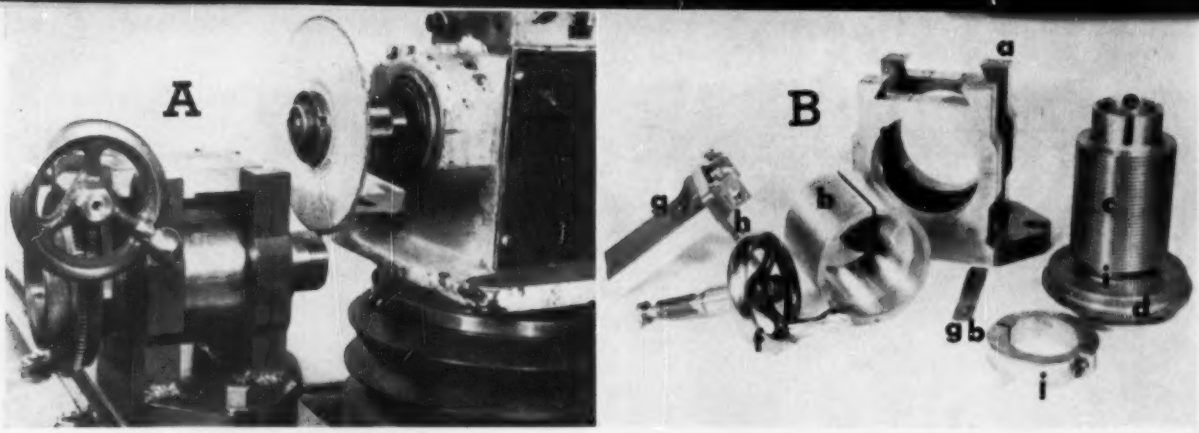
A band of plastic or leather placed over the tacks and attached with decorator's tacks adds the finishing touch. Following this step, the pair of drums are bolted together. Allow a few hours for the skin to dry taut, and then, as they say like in Squareville . . . "Stand back and give him room, another beatnik's hit the moon!" ★

Bongo drums can be made any size. The size, however, determines to a great extent the drum's pitch.





JIG FOR CUTTING DRUM SEGMENTS



Teaching creativity in the machine shop

Production Planning a Project
(Part Three: Auxiliary Tools)

By H. J. Gerber
Head Machine-Shop Department, Oklahoma State University, Stillwater

THE word "tools" has a wide area of meaning in the machine shop. "Machine tools," which are the basic equipment for the whole metalworking industry, are defined as; "power driven machines, not portable by hand, which remove metal in the form of chips or which form metal by bending, pressing, hammering, etc."

Various standard accessories are used with these basic machines for the usual problems involved in making precision metal articles on a non-production or small quantity basis. These accessories are also "tools." Such standard accessories are, however, not often suitable for quantity production work so industry is forced to design and build special "tooling" of various types to increase the efficiency of these machine tools for economical and accurate production of quantities of identical parts.

The previously discussed "fixtures" and "jigs" (SCHOOL SHOP, Sept. 1960 and Jan. 1961) account for a large proportion of the special tools commonly used in the production shops. In addition to these, there are a number of other categories which occupy the creative efforts of production planners and tool designers. There are no limitations. Any sort of a device which might be attached to, or used with, any standard machine tool for improving its efficiency would qualify. What is important is that the "tool" increases production – or more accurate production – than would be possible without it.

The tooling illustrated in this article was student designed, and student built, to assist in the manufacture of "Omega" dividing heads in our machine-tool laboratory classes. The tooling illustrated, none of which can be strictly classified as jigs or fixtures, include some special machine-tool attachments, punch-press dies, and a number of relatively simple work-holding devices and modifications of standard tools. The intention is to illustrate a few representative types of student-developed tools and processes rather than to enumerate or picture the complete inventory of tooling for this particular project.

In our classes, we like to consider the creative planning of tools and processes as a game rather than a task; a game which pits the intelligence and ingenuity of the student against the apparent limitations of the basic, standard machine tools which are available in our shop. The student is never inhibited. The only ground rule of the game is that any tool or process which he might develop must function with, or supplement, the machine tools we have on the shop floor. The emphasis is not on the motor skills of production but rather on the methods of planning and techniques of tooling for production.

The first illustrated example (Fig. A) is a typical problem. It was necessary to precision grind the screw threads on the nose of the hardened main spindle of this dividing head. The hollow spindle is made of 52100 alloy steel, hardened to 63 Rockwell C, and ground on all important surfaces after heat treatment. We have no thread grinder in our shop, so we had to improvise.

Because an engine lathe is commonly used for generating screw threads, the first attempt at thread grinding was made by use of this tool. A standard tool post grinder, adapted by a special mounting, was used to grind threads on a number of pieces with some degree of success. However, it was not considered a satisfactory process for a number of reasons: The process was too slow, possibility of damage to the machine from abrasive grit was great, wheel truing was difficult, etc. Another approach was then suggested.

A Cincinnati tool and cutter grinder was available and considered for adaption to the job. This machine was never intended for use in thread grinding, and no standard equipment is available to convert it to such use. Nevertheless, there were a number of important points in favor of its use: The machine has a finely built wheel spindle and bearing unit – a must for any precision grinding job – and it has a number of precision slide movements which could be used for work positioning in a much more efficient manner than would be possible with the lathe. An obvious drawback was the absence of any sort of a lead screw which might be used to guide the necessary helical movement of the work

or the grinding wheel. The heart of the problem then was to develop an attachment which would be able to feed a piece of work to the grinding wheel through a helical path.

The illustrated attachment (Fig. A) successfully solved the problem. It is designed specifically for this job and is useful only for a given diameter and a given thread pitch so it is not intended for general use.

The thread is being ground by the wheel directly above it (wheel guard has been removed for photographic purposes). The swiveling top table of the machine has been offset to the helix angle of a 1½"-8 thread. By turning the handwheel on the attachment a lead screw within the stationary bronze nut is made to revolve and advance toward the grinder wheel head. The work is contained in this lead-screw spindle, the nose of which is a precision split collet.

Increases of cut depth for subsequent passes of the work through the wheel are made by lowering the wheel head the desired amount before beginning each pass.

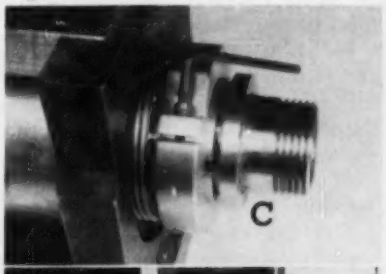
Illustration (Fig. B) shows the parts of the disassembled thread grinding attachment: (a) housing, (b) split bronze nut which is fitted into housing, (c) master lead-screw spindle with integral collet, nose (e) and attached worm gear (d), (f) handwheel attached to worm, (g) dovetail slide which is a carrier for the worm and handwheel. This carrier moves along the top of the housing as the spindle (c) advances. This movement is transferred through engagement of the yoke (h), on the end of the carrier slide, with a neck (i) located on the spindle adjacent to the worm gear.

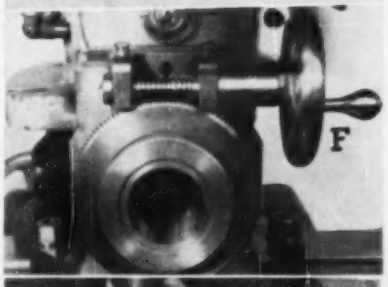
The spindle lead screw is hollow. Its inside diameter corresponds to the diameter of the previously ground body of the workpiece. To grip the work, collar (j) is tightened around the nose of the spindle as shown in (Fig. C).

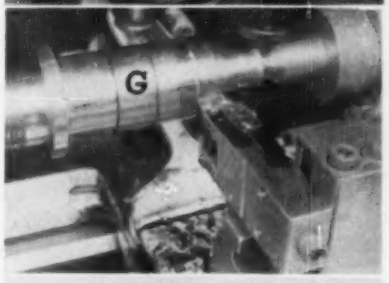
The rotation of the work is controlled to the desired slow rate by means of the worm and worm gear. This also helps to control dwell in making a neat thread termination.

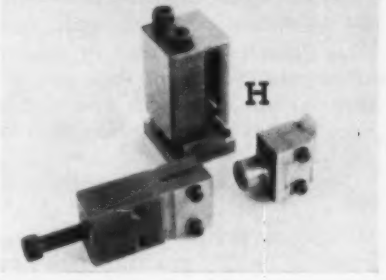
Wheel truing to the required 60° angle is accomplished by the use of a two diamond truing device mounted on the machine table (Fig. D). When the wheel is in need of truing, the table is unlocked and run over until the device is in position exactly under the wheel center line. A witness mark, scribed on the table, assures this location and another one permits quick relocation of the grinding attachment under the wheel center line.

A completed workpiece is shown in Fig. E.









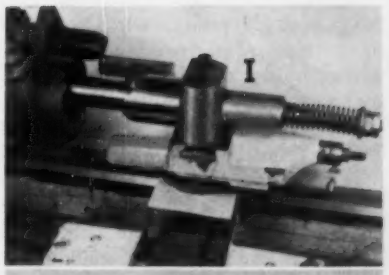
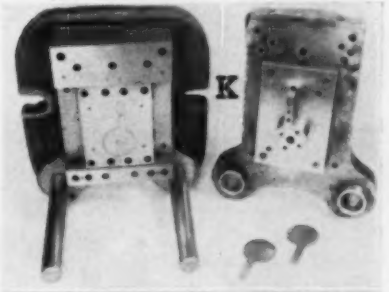
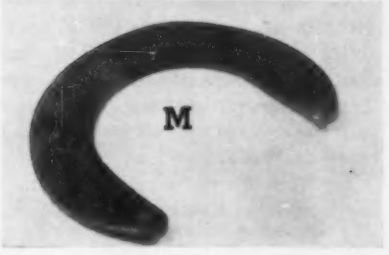


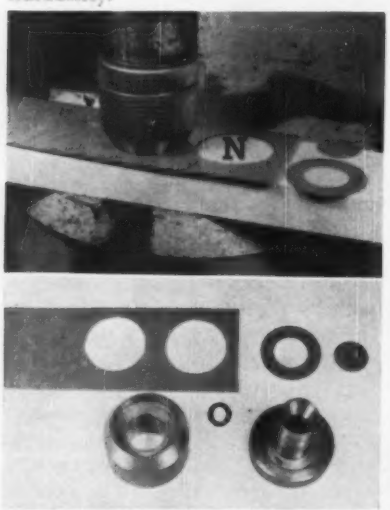
Fig. F is a rear view of the attachment showing worm and worm gear with hand rotation wheel.

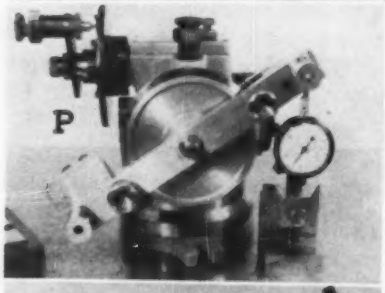
Figs. G and H are a student designed thread-chasing attachment for use on an engine lathe. This tool holder is used for chasing a precision thread on the rear of the dividing head spindle. This end is machinable as the result of a tempering operation after hardening. The attachment permits finishing this thread in just four passes of the tool as compared to approximately twenty passes required

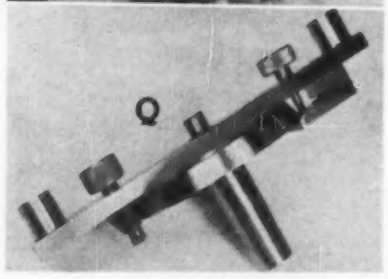




with a single point tool. The cutter is a standard die-head chaser. This chaser holder can be used for general purpose work by substituting other chasers and adjusting the swivel head to any required helix angle. The tool has a variable height adjustment to permit it to be used on other lathes of different center height. The tool is hardened and ground throughout for durability.





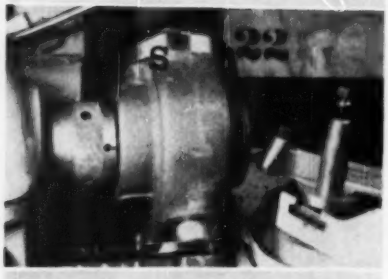


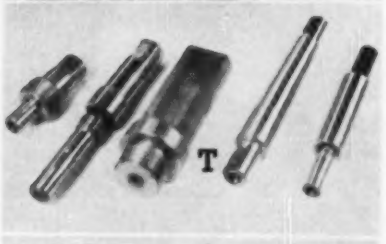
Figs. I and J are an oil-grooving attachment for cutting a figure "8" oil groove in the front main bearing of the dividing head housing. As the work is rotated in the lathe, it drives the cam which actuates the follower roller on the boring bar. This face cam, designed specifically for this job, controls the path of the cutting tool in making a continuous helix of both right- and left-hand lead.

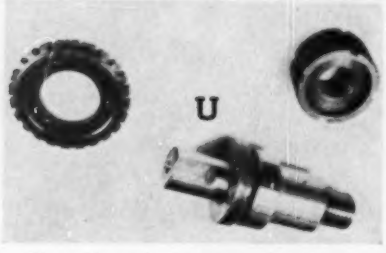
Fig. K is a blanking die and punch for sector-arm blanks. This hardened and ground, tool-steel die is mounted in a commercial die set for use in our 25-ton crank press. It is used to blank the workpieces from 3/16" hard-brass, plate stock. These blanks will later go through several machining operations for completion.

Fig. L is a combination blanking and forming die for producing a "U" spring washer which is used to tension the sector-arm assembly. These spring washers are made of oil-hardened tool steel and are heat treated after press working.

Fig. M is an enlarged view of a spring washer showing its shallow dish shape which is produced in the same press stroke as was the blanking.







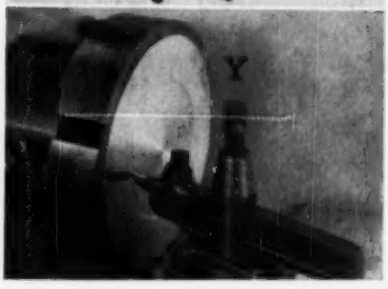
Figs. N and O are a simple, two-piece "dinking" die used in a hand arbor press. Several of these dies are used to blank and punch a number of sizes of fiber thrust washers used in this project.

Figs. P and Q are production tooling which include many types of special gaging devices to check the accuracy of finished products. This sine-bar gage, specially made for this job, is used to verify the working accuracy of a completed dividing head. The instrument is used in conjunction with a sensitive dial indicator and standard gage blocks to prove out a number of angularity settings which confirm the final accuracy of the worm and worm gear as well as the spindle and bearing assembly.

Figs. R and S are an expanding plug mandrel for mounting a partially completed housing for a secondary machining operation. It is made of tool steel, hardened and ground. This adapter is screwed on the spindle of a small engine lathe and holds the work by expansion of its body when the taper screw plug is tightened.

Figs. T and U are a selection of special mandrels used for holding parts in lathes, cylindrical grinders, and other machine tools during processing.

(Continued on page 20)



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- Machinery Table, 48" x 36", welded steel, shelf

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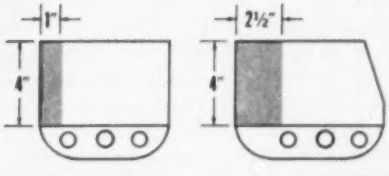

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V-7RDT	4 x 7	9	Dog	Rapid Acting	Steel	30
V-7CDW	4 x 7	9	Dog	Solid Nut	Wood	29
V-7CDT	4 x 7	9	Dog	Solid Nut	Steel	30

for best advice about **Vises** . . . see your **Columbian** distributor.

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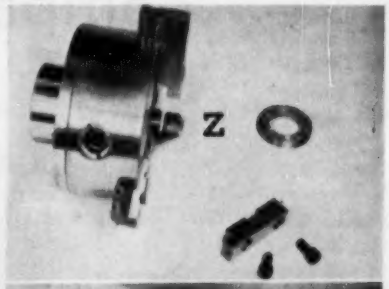
Tools . . . . . *from page 18*



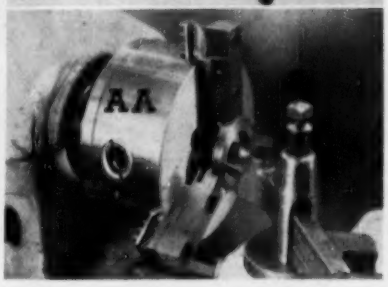
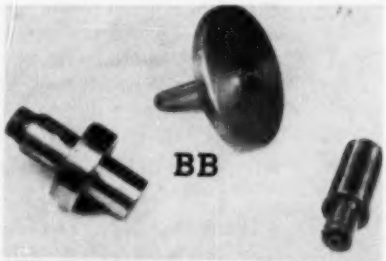


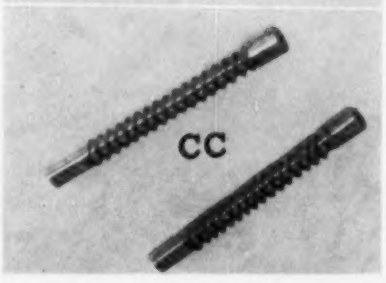
Fig. V is a detail of another type of expanding plug mandrel used in a turret lathe for holding work for secondary machining operations. Fig. W are standard core drills which have been modified for off-standard counterboring and countersinking operations.

Figs. X and Y are special step jaws fitted to a standard lathe chuck to adapt it for efficient gripping of work.

Figs. Z and AA are special threaded chuck jaws for holding a threaded adjustment ring for final machining operation.

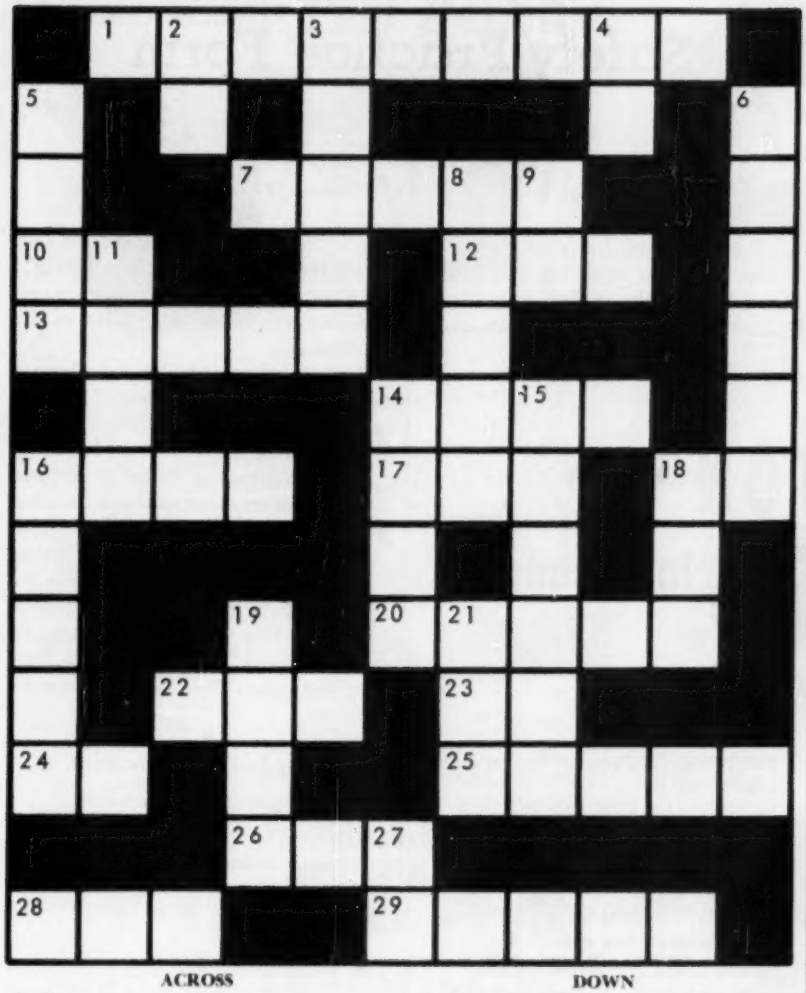
Fig. BB is a group of expanding plug mandrels. Fig. CC is a pair of special square-hole broaches used to finish a square hole in the spindle lock shoe housing. ★





A Puzzle about Magnetism

By Jerome Ludwig
Uniondale, Long Island, High School, New York



ACROSS

1. Name for a natural magnet
7. A nonmagnetic substance
10. A magnetic substance when alloyed with steel (reverse the letters of the symbol)
12. Not a permanent magnet (first three letters only)
13. Pole of a magnet
14. This will destroy magnetism
16. If a magnet _____, it might lose its magnetism
17. Practically _____ materials will allow magnetic lines of force to pass through
18. Ore sample (abbrev.)
20. Magnetic attraction and repulsion makes it possible to _____ a d-c motor
22. An iron _____ can be used as the core of an electro-magnet
23. When used with a coil, can be useful in destroying magnetism (abbrev.)
24. When used with a coil, can be useful in creating magnetism (abbrev.)
25. The North and South of all magnets (plural)
26. The greatest concentration of lines of force of any magnet are here
28. A substance with more resistance to magnetic lines of force than iron
29. Magnetic lines of force never _____ each other

DOWN

2. Magnetic substance when alloyed with steel (abbrev.)
3. This pole of a magnet will repel the north pole of another magnet
4. The direction a magnetic south pole of a magnet will take in relation to the north pole of another magnet
5. A material with a high degree of permeability
6. Unlike poles have this effect on each other (plural)
8. A material with a high degree of retentivity
9. A point on a magnetic compass
11. The strongest concentration of magnetic lines of force in a solenoid
14. _____ steel is necessary for a strong magnet
15. Permanent magnet
16. Lines of force
18. Source of lodestone
19. What will happen to the magnetism of a horse-shoe if a keeper is not used
21. Do this hard enough to a magnet and you will destroy its magnetic strength
27. Direct current (abbrev.)

The solution to this crossword puzzle appears on page 44.

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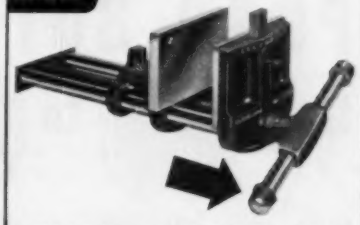

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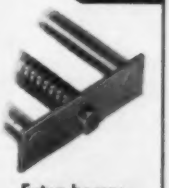

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Safety-Practice Form

By Donald P. Hoagland
West Essex High School, West Caldwell, New Jersey

SAFETY is always a major consideration of any industrial-arts teacher. Instilling good safety habits is a continuing process that must be kept in the forefront at all times.

One of the most difficult features of safety education is the devising of some means for helping the student accept his personal responsibility for safety in the shop.

An attempt has been made toward this end by the use of the following form. This form combines a student safety pledge with the parental permission for machine operation, which is often required by school systems.

The parent is made aware of what is required of the student, thus helping to impress on the student the fact that safety is partly his responsibility. He must do or refrain from doing certain things to fulfill his portion of the agreement.

The school assures the parents that each student will have proper instruction before he will be allowed to operate machine tools.

The advantage of this type of form is that all three concerned—the school, the parent, and the student—are included in the safety program, giving the student definite responsibilities for his portion. It is also general enough in nature that it can successfully be used in all areas of the industrial-arts program regardless of the specific offerings.

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Industrial-Arts Department

_____ _____, who is enrolled in an industrial-arts course, will, as a part of his shop experience, operate machines, providing that his parent or guardian gives written permission.

It is understood that each student will be given proper instruction, both in the use of the equipment and in correct safety procedures concerning it, before being allowed to operate it himself.

The student must assume responsibility for following safe practices and we therefore ask that he subscribe to the following safety pledge.

Safety Pledge

1. I promise to follow all safety rules for the shop.
2. I promise never to use a machine without first getting permission, each time, from the teacher.
3. I will not ask permission to use a particular machine unless I have been instructed in its use.
4. I will report any accident or injury to the teacher immediately.

Date_____ Student's Signature_____

I hereby give my consent to allow my son to operate all machines and equipment necessary in carrying out the requirements of the course in which he is enrolled.

Date_____ Parent's Signature_____

Parents are cordially invited to visit the shops to inspect the machines and to see them in operation. ★

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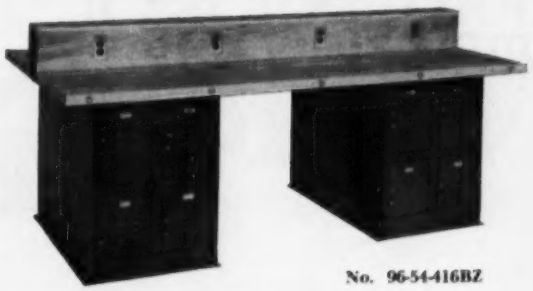

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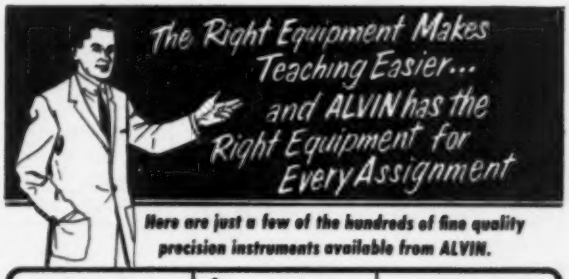

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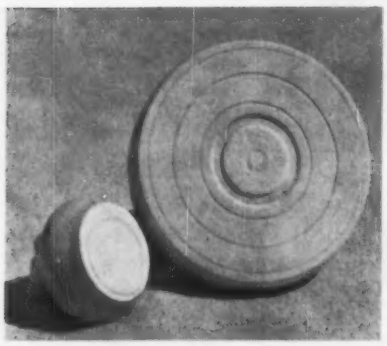


One way to form

Perfect Feet for Thrown Pots

By F. Russell Abrams
West High School, Rochester, New York

CUTTING a foot into the bottom of wheel-thrown pottery is often a troublesome process for students. It is difficult to achieve concentricity while attaching an upside-down-pot to the bat, and the upper edge of the thrown pot is always marred.

To avoid these faults and to secure a perfectly formed foot, I teach my students a method that uses a plaster bat keyed to the wheel and with a groove cut into the upper surface of the bat.

The key is simply an odd shaped piece of wood with proper draft bolted to the wheel head. Bats are cast right on the wheel head by wrapping a heavy paper strip around the circumference to form a plaster cottle. After the bat hardens, a screw-driver tip is used to scrape a deep groove of the desired diameter into the plaster as the wheel revolves.

When the pot is thrown, the clay pushes into the groove the same as it does when press molding. The resultant foot is always concentric with the work. The work is not cut from the wheel but is allowed to shrink slightly and then lifted off.

If several bats are made, the work may be removed from the wheel head while still on the bat and the machine is free for another student. There is no difficulty in recentering since the key relocates the bat precisely in the original position. ★

This has implications for math students as well as drafting students

The Impossible Square

By Ernest C. Carlson
Laytonville, California, Junior-Senior High School

THE "Impossible Square" is one of the oldest cut-wood puzzles, but because of its appeal to the younger generation it bears reprinting once or twice during every decade.

I have used this puzzle in my junior-high shop classes to teach the concept of area and how it is measured. Boys at the junior-high level express a great deal of interest, and I find it provokes a good deal of interesting discussion related to mathematics.

The graphic solution to the problem makes an interesting mechanical drawing problem as it requires an extremely high degree of accuracy in layout and transfer of dimensions. It may also serve to introduce methods of graphic solutions to mathematical problems.

The mathematics department can use this to challenge their more able mathematics students, and the instructor can find some rewarding implications in the relation of this to the fabled golden rectangle of yore.

To construct the "Impossible Square" proceed as follows:

1. Accurately cut an 8" x 8" square from ¼" plywood.

2. Accurately layout the square as shown in Figure 1.

3. Carefully cut pieces A, B, C, and D. Keep saw kerf to a minimum.

4. Reassemble after cutting, letter squares, and note that reassembled pieces measure 8" x 8", and make a square containing a total of 64 square inches. See Fig. 1.

5. Rearrange pieces A, B, C, and D as shown in Fig. 2. Measurement will indicate a rectangle measuring 5" x 13" or a total of 65 square inches.

Obviously this is an impossible situation but the where and why of the additional 1 square inch provides some interesting discussion, and, as I have stated before, a good mathematics or drafting problem. ★

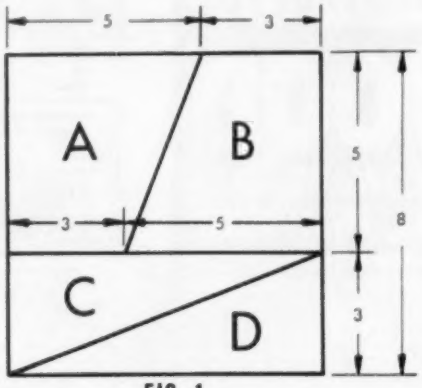
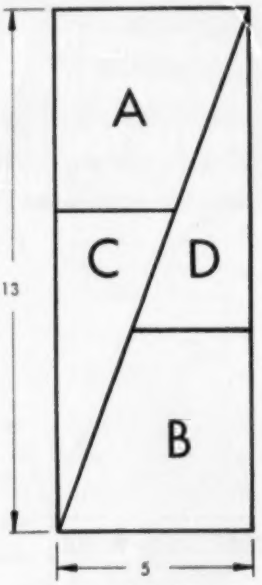


FIG. 1

FIG. 1 $8 \times 8 = 64$ IN^2

FIG. 2 $5 \times 13 = 65$ IN^2



THE IMPOSSIBLE SQUARE

FIG. 2

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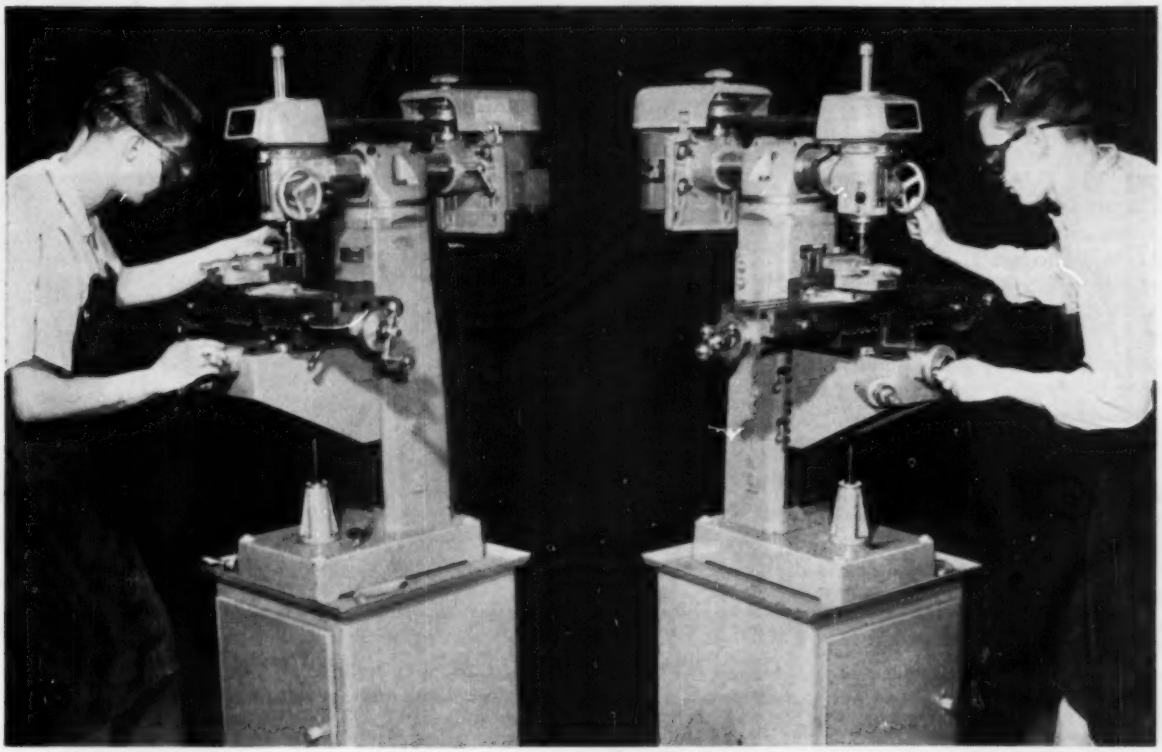

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Mass Production in the Shop Can Be Made to Work

By Lewis B. Manges

Head, Industrial-Arts Department, Laguna Beach, California, High School

A VIRTUAL cinch to win any understatement contest would be this simple but true description of the world today: It is an industrial-technological world characterized by rapid change and growth. But, certainly no understatement is this query: How many people understand what is going on technologically and industrially in the world today? Very few is a reasonably accurate estimate.

One of the objectives of industrial arts is to teach youth just what is happening, and the task of fulfilling this objective in general education has become amazingly complex, will become more so as we enter the space age, and in no time at all will become nothing short of a heroic chore, if it isn't that already.

A big leap can be made across the gap from a lack of understanding to an appreciation and understanding of the trades and industries represented in industrial arts by introducing the assembly line in our program. A short unit in mass production, lasting from two to five weeks, could supplement and enhance present offerings and also could be more of a problem-solving activity than the traditional project. According to many leaders in the field, the trend or reemphasis on problem solving is the biggest single identifiable trend in industrial arts today.

A list of projects or problem activities that lend themselves to this type of activity follows:

Wood

Book ends	Houses, bird
Box, tool	Houses, dog
Box, card file	Holder, misc.
Box, jewelry	Picture frame
Box, shoeshine	Toys, misc.
Bulletin board	Trays, tool
Cribbage board	Trays, serving
Games	T-square
Gavel	Water skis

Metal

Anchor	Fireplace set
Barbecue set	Furniture, lawn
Book ends	Gaff
Box	Hammer
Brazer	Paper weight
Candelabra	Tools, misc.
Castings, misc.	Weather vane
Fins	Wire sculpture

Wire stripper

Electronics

Auto troublelight	Microphone
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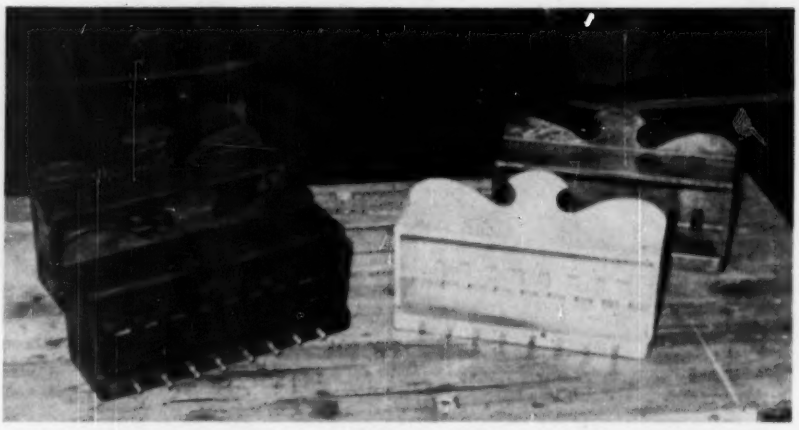

Some of the spice racks made by the author's students in a mass-production unit. Seventy-five of these units were made by 18 ungraded students at the senior high-school level.

The key to mass production is organization efficiency. This calls for careful planning. The smallest detail must not be overlooked. The objectives must be listed. Students must be drawn into the planning to select and plan for their problem area or project. The time when all of this is to happen must be decided. The program must be fairly well set before it goes into action, but room must also be allowed in it for student additions and opinions. Finally, the students must be introduced to the idea before any of the aforementioned will take place.

A simple but effective approach is a lecture and a brief study of our industrial system. If this is carefully prepared, including key phrases aimed at drawing comments from students, the boys might suggest, "Why can't we do mass production in this shop?" Should this happen, you are off and running!

After student interest is aroused, move on to selection of a project and get your organization started. Students should be brought into the project-selection phase. Once the project is picked, move briskly to organizing for production. Get your students to help select and elect officers and job holders. These include foremen, quality-control and production directors, jig makers, the pilot-study group, a cost accountant, draftsmen, public-relations workers, a safety engineer, assemblers, checkers, machine-tool operators, and anyone else you need for the job.

Once the organization is completed, it is time to get production rolling. Now is the time for the foreman to assume as much of the responsibility as is feasible, and for you, the teacher, to step out of the picture and serve as a consultant.

The students who were assigned to the pilot-model and mock-up groups should have ready for class consideration a three-dimensional model of the project. The draftsmen, it should be noted, in the meantime, have been working closely with this group.

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what most of the class has been doing while this preparation work has been going on. Simple! They have been working on projects assigned them before we started the mass-production unit. Due to differences in abilities some of the students finished their projects before the others did. Consequently, the fast workers were brought in on the planning for the mass-production stuff.

When a question arises in the early stages that you feel is of interest to the entire class, then the entire class should be brought in to help answer the question or solve the problem. This was our procedure at the beginning and up until everyone could get in on the work.

Now, we have arrived at the pilot-model stage. The class's approval is necessary before the big work can begin. If the class feels the pilot model should be modified in some way, then the people responsible for this should get busy and make the modifications.

At this point, resource people from industry can help considerably with their suggestions which are based on the "real thing."

Now, working drawings start flowing from the drawing room. Students assigned to cost accounting of the project come up with their figures pertaining to materials, labor, and time. (In a simple, but nonetheless real, fashion the truths of the economics of production — money, banking, financing, etc. — can be introduced here.)

The students assigned to making jigs are busy with their assignments. And the safety engineer is watching the work closely to make certain of safe working conditions.

In keeping with industrial practices, each student does one operation throughout the entire assignment, and it is the foreman's responsibility to see that each student performs his task to the best of his ability.

Students assigned to the public-relations aspect of the unit should inform the administration, the editors of the school newspaper, the P.T.A., and organizations in the community about what is going on in the shop and even invite people to the shop to see for themselves how the production line is functioning.

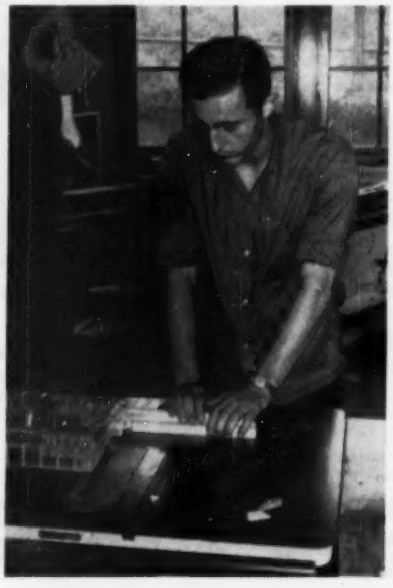
Because mass production lends itself to a large variety of projects, a problem might come up about what to do with the items when they are completed. If the unit is done before Christmas, the items can be used as gifts. Organizations in town may be interested in selling them as fund-raising gimmicks with the proceeds going to charity. The P.T.A., church groups, and welfare organizations would be particularly appreciative of this.

At the conclusion of the unit, an open discussion is held to evaluate what has been done. Visits and suggestions from local industrial leaders are welcome. Or, a visit to a local plant where real, live production is in operation is another fitting way to wind up the project.

We did a successful mass-production unit at Laguna Beach High School. A class of 18 ungraded high-school students (9th, 10th, and 11th grades combined) produced 75 spice racks in a three-week period of actual production time. An additional week was spent on preparation. On the basis of this experience, we feel the program could be done successfully at the junior-high-school level as well. Furthermore, it is practical to consider this sort of group effort to involve more than one shop area.

Mass production has its place in modern industrial society and so it also has a place in the industrial-arts program in our public schools, where the objectives of industrial arts can be met to a great degree by an instructional unit of this type. The real question is: Can educators meet the challenge and do in practice what is held in theory? ★

One of the students at Laguna Beach High School using a simple jig in a cutting operation. Safety should be considered as important a function as is the actual construction.



News ABOUT TRAINING
The Technician

Engineering Technician Certification Program Approved by the NSPE

THE National Society of Professional Engineers has approved an engineering technician certification program and a committee is presently working on its "implementation and inauguration."

In effect what it amounts to is this. The Engineering Technicians Committee of the NSPE has recommended to the group's board of directors that: (1) the board "approve a change in terminology for the top grade of Engineering Technician from 'Certified Engineering Technologist' to 'Senior Engineering Technician' "; and (2) that the board "approve the governing documents for the creation and operation of the 'Institute for Certifying Engineering Technicians'."

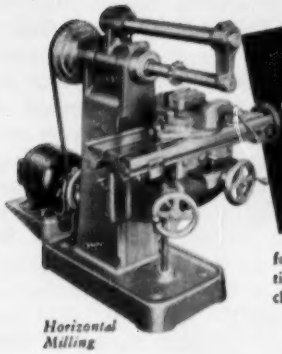
The committee has also recommended that three grades of engineering technicians be established: (1) engineering technician trainee; (2) engineering technician; (3) senior engineering technician.

The committee visualizes two different routes to the first two grades, but a common route to the third and top grade. The different routes are: via experience and training on the job plus professional endorsement, or graduation from an Engineering Council for Professional Development approved education program. After successfully travelling either route the candidate becomes an "engineering technician trainee."

The trainee, now a candidate for the "Engineering Technician" grade, has still open two routes to the next grade: via more experience and examination plus professional engineering endorsement, or, if he graduated from an ECPD program, work experience plus professional engineer endorsement.

From this stage on, the engineering technicians, regardless of how they got this far, would follow the same route to certification as "Certified Engineering Technician": possibly an examination, but definitely more experience plus professional engineering endorsement.

Other recommendations of the Engineering Technician Committee of the NSPE are:



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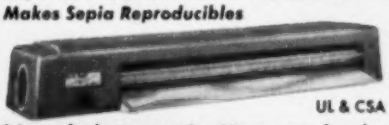

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"1. The NSPE should make no attempt to foster an organization of engineering technicians within its own structure;

"2. NSPE's occupational guidance activities should include guidance for prospective engineering technicians in the same manner that guidance activities are conducted for prospective professional engineers;

"3. NSPE should, consistent with the objectives of the Society, be concerned with anything which would improve the situation of the engineering technicians, and this would include industrial training programs;

"4. NSPE should make no attempt to foster by legislation qualifications for engineering technicians;

"5. NSPE should cooperate with technical institutes and other suitable technician training programs following the same pattern that now exists in NSPE's cooperation with engineering college programs."

The Society's Committee has also taken steps to establish an "Institute for Certification of Engineering Technicians and Certified Engineering Technologists." The Institute would, then, be responsible for the certification and the granting of certificates to qualified persons. The Institute would be operated by a board of directors comprising equal numbers of registered professional engineers and certified engineering technologists. The Committee recommends that "Preferably, the PE's (professional engineers) on the Board would be selected from the fields of consulting, education, government, and industry."

Although the Committee did not recommend a society within its own group for technicians, it did feel that "in time a national society of engineering technicians and technologists will be established, which would then select the CET (Certification of Engineering Technicians) Board."

As for the examination, the committee recommended that it be prepared centrally, but "administered locally with the cooperation of the state societies (NCPE) and their local chapters, the local organizations of the technical societies. Examinations would be returned to the Institute for grading and evaluation."

The Committee has noted that the "establishment of the Institute should provide a much needed means of recognizing the status of technician members of the technological team. It should also lead to the upgrading of the education and work experience as well as the continued selfdevelopment of the technician."

Georgia School Evaluation

A STATE evaluation committee for area vocational educational programs is now active in Georgia. Composed of school administrators, with federal, state, and local vocational education leaders serving as consultants, the committee reports its findings and recommendations to the Georgia State Board of Education. ★

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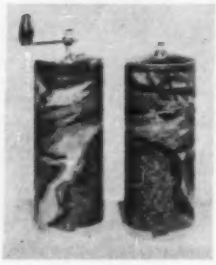

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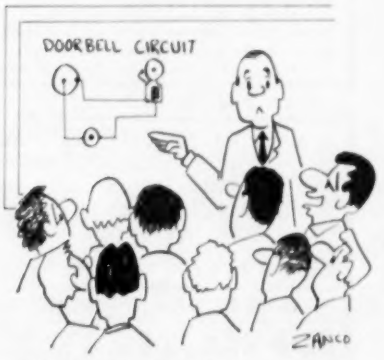

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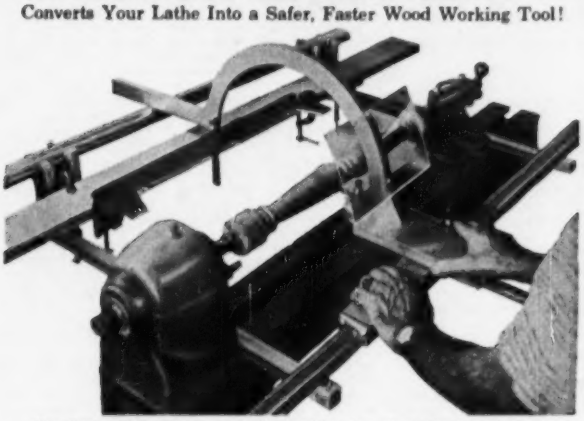

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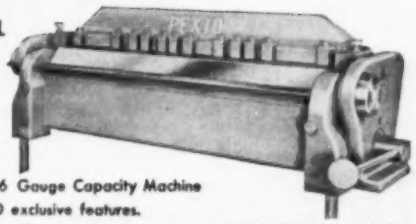

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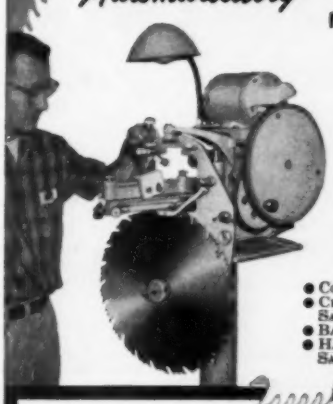

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Zanco, M. L. Letterholder of Iron. Feb., 47.

happenings in industrial education

Ford Drops IAA Program

THE Industrial Arts Awards program, sponsored and conducted by the Ford Motor Company for the past 11 years, is now officially under the sponsorship of the American Industrial Arts Association.

The Association in April received a grant of $81,500 from the Ford Motor Company to support the competition for three years. Ford officials felt that the program had grown and expanded to a point where it needed professional development. AIAA President Ivan Hostetler, in announcing the grant from Ford, said that the AIAA decision to conduct the program "was made because our Association recognizes that such programs are best operated by educational organizations and by experts in the field of education."

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New Jersey Officers

WILLIAM VROOM of Trenton Central High School is the new president of the New Jersey Vocational and Arts Education Association.

Mr. Vroom, who was elected at the convention of the association in Asbury Park in March, succeeds Leonard J. Skolnick, Newark. Other officers named at the convention were: Burr D. Coe, Middlesex County Vocational and Technical High School, first vice-president; Rosalie C. Risinger, Essex County Vocational and Technical High School, second vice-president; William M. Devonald, Newark, third vice-president; Richard O. Harthmann, Jersey City, secretary; and Edmund A. Boyer, Jr., Merchantville, treasurer.

Summer Workshops

MANY summer workshops have been planned throughout the country for industrial-education teachers. Included among them are the following:

University of Idaho, Moscow. — Three short workshops are planned: power tool maintenance, June 20-23; finishing materials and methods, July 3-14; and general metals, July 17-18.

Southern Illinois University, Carbondale.—A series of four two-week intensive courses will be held during the summer session. Topics will include: "The Area Technical School of the Future," "Comparative Industrial Education with Special Emphasis on the Russian System of Industrial and Technical Education," "Professional Writing for Publication," and "Industrial Arts in the 1970's."

Minnesota Industrial Arts Summer Workshop.—The sixth annual workshop sponsored by the Birch Coulee Industrial Arts Club in cooperation with Bemidji State College and the Vocational Division of the Minnesota Department of Education will be held at North Central School and Experiment Station near Grand Rapids, Minn., Aug. 13-19. A new course in art craft metal work will be added to a course on small engines, first offered last year.

AIAA Meeting in June

One of the highlights of the annual NEA convention, to be held June 25-30 in Atlantic City, N.J., will be a departmental meeting of the American Industrial Arts Association on June 28.

Speakers at this special meeting will be Representative Frank Thompson Jr. (D—N.J.) and M. Ray Karnes, professor of higher education, University of Illinois, and former president of the AIAA.

The meeting will have special appeal to those interested in federal legislation for education and those interested in the latest developments in industrial-arts education.

I-A Course Strengthened

Wisconsin State College and Institute of Technology, Platteville, has announced a strengthening of its industrial-arts curriculum to better prepare its graduates for teaching or for industry.

To give more preparation in depth, a comprehensive major in industrial arts has been introduced that requires 68 semester hours. Students desiring to teach take extra work in any two of the following six areas: metal fabrication, graphic arts, wood technology and practice, electricity and electronics, drafting and design for the building industries, and technical drafting. Students who do not care to teach take 14 to 18 credits in any three of the six areas to prepare them for industry.

The mathematics, physics or chemistry, history, English, and other academic requirements have been retained. ★

Convention Calendar

Georgia Vocational Association, Atlanta Biltmore Hotel, Atlanta, June 8-9.
Colorado Vocational Association, Colorado State University, Fort Collins, June 12-16.
Idaho Vocational Association, Idaho State College, Pocatello, June 12-16.
International Graphic Arts Education Association Conference on Printing Education, Ferris Institute, Big Rapids, Mich., July 30-Aug. 4.
Virginia Trade and Industrial Education Service, Virginia Polytechnic Institute, Blacksburg, Aug. 7-11.
Kentucky Industrial Education Conference, The University of Kentucky, Lexington, Aug. 14-19.
Louisiana Vocational Association, New Orleans, Aug. 17-19.
Ohio Vocational Association, Southern Hotel, Columbus, Sept. 29-30.
New England Industrial Arts Teachers Association, Hotel Viking, Newport, R.I., Oct. 13-14.
Kentucky Industrial Education Association, Kentucky Hotel, Louisville, Nov. 3-4.
American Vocational Association, Kansas City, Mo., Dec. 3-8.

*strictly personal

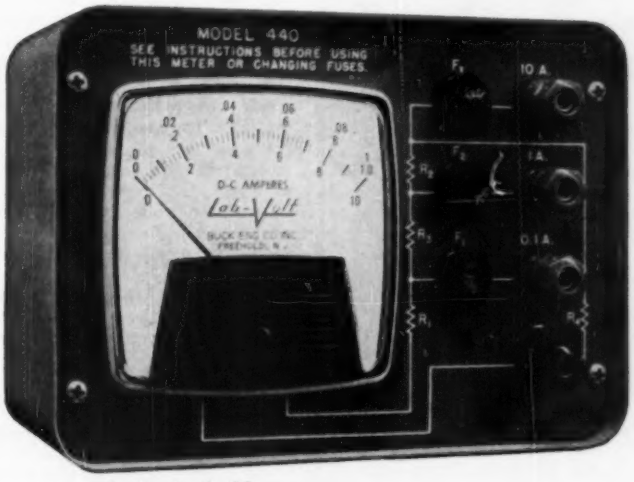
H. J. Gerber has joined the staff of Stout State College. Formerly of Oklahoma State University, Stillwater, he is a frequent contributor to national metalworking publications as well as educational journals, including School Shop.

Don R. Sheets, now coordinator of trade and industrial education in the practical-arts division, Kansas City, Mo., schools, was a high-school, auto-mechanics instructor and regional reconditioning instructor for Chevrolet in Kansas.

Francis C. Osborn, who has been on the industrial-education staff of Arizona State College, Flagstaff, for the past 37 years, has announced his plans to retire. Professor Osborn is well-known throughout the southwest for the many industrial-arts teachers who have received their training under him.

Edward R. Towers, Ohio State University, is expected to return to his position in July 1961, following a two and one-half year tour of duty in India for the ICA and the Indian Ministry of Education.

George Wetzel, now supervisor of practical arts for the Akron, Ohio, public schools, succeeds **Ernest R. Statler,** retired. ★



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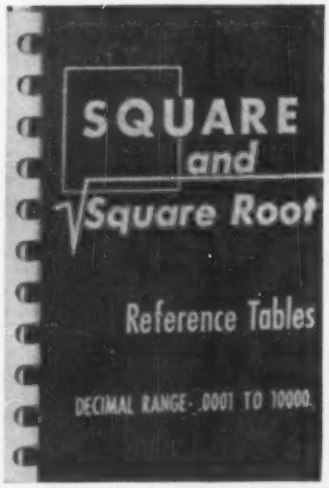

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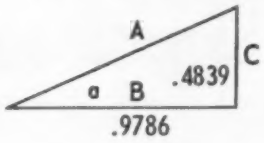

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instructional Resources

Books:

Mechanical Drafting Essentials. (Third Edition.) McCabe, Keith, and Farnham. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961. Pp. v + 263. $4.00

This is a combination text and workbook. Problems are shown and solved on cross-section work sheets permitting work to be done freehand without the use of a scale.

Primary emphasis is on reading, interpreting, and sketching. Subject matter is introduced in logical sequence of small units, and each unit is followed by worksheets which provide practice in developing the new idea. For the basic units of instruction, the worksheets are arranged to provide try-out, actual work, and test. Supplementary problems are presented at the end of each instructional unit. The worksheets may be removed from the book, leaving the text and explanatory materials intact.

Handicrafts Simplified. Amon and Rawson. Bloomington, Ill.: McKnight & McKnight, 1961. Pp. 210. $4.40.

This book covers 16 major craft areas using step-by-step instructions and more than 300 illustrations to teach techniques and procedures in the various fields.

Original, creative design is emphasized; material about the use of tools and present-day application of each medium is brought up to date.

The authors have brought together material on the major crafts and have presented it so that the novice and the experienced craftsman will find it helpful.

A list of "Sources of Supplies," and a list of reference materials are included.

Cutting Tools, Jigs, and Fixtures. Town. New York: The Macmillan Co., 1960. Pp. 247. $6.00.

The first part of this book surveys recent developments in the various types of cutting tools, deals with the basic features of tool design including heat treatment, tool grinding, cutting speeds, and feed rates, etc.

The second part is devoted to jigs and fixtures and is complementary to the first part by relating modern developments in cutting tools to operations involving well-designed jigs and fixtures. Examples are given of a wide range of jigs and fixtures including pneumatic and hydraulic devices.

The book includes a comprehensive set of examples of problems in both cutting tool and jig and fixture design.

Tool & Die Drafting. (Second Edition.) Hoover and Schumacher. Detroit: Royalle Publishing Co., Inc., 1960. Pp. ix + 196. $3.60.

This text represents the cumulative experience of teaching tool and die drafting in the Detroit area since the end of World War II.

Theodore W. Hoover, head, vocational department, and Herman G. Schumacher, principal, Cody High School, Detroit, have designed the book for use with high-school, vocational apprentice, and evening-school classes.

The text material has been used to teach the fundamentals of drafting through the use of "live" tool, die, and fixture parts. From the fundamentals, the student progresses to the actual detailing of industrial tools, following the procedures and practices used in industry, and, from these, to the actual design of jigs, fixtures, and dies.

In the preface, the authors state: "The novice tool designer learns generally by examples rather than by reading. Therefore, lengthy and wordy explanations have been carefully avoided. . . . Although there are some differences in company standards there is enough uniformity between companies that a student following the methods shown in this text will have very little trouble adjusting to the standards and methods of any company."

Handbook of TV Troubles. Heller. New York: Holt, Rinehart and Winston, Inc., 1960. Pp. vi + 302.

This manual is intended to be used as a guide by technicians and hobbyists who encounter trouble in the operation of TV equipment. The material covers the various problems with which the operator has to contend.

On the inside of the cover, a chart is provided which enables the reader to locate in the manual the causes and remedies for the difficulties that are likely to appear. These difficulties are grouped under four heads, namely: brightness troubles, control troubles, picture distortion troubles, and unsatisfactory picture detail.

Teachers who include instruction on TV in their courses will find the book to be a valuable reference.

Sol Heller is instructor in electronics in the New York Trade School.

Pamphlets:

Automobile Facts and Figures and **Motor Vehicle Manufacturing** in the United States are two new booklets published by the Automobile Manufacturers Association, Incorporated.

The first is a 72-page booklet containing a wide range of statistical information concerning automobile production, ownership, and much demographic information.

The second is a 17-page booklet that was originally prepared to explain the processes involved in auto manufacturing in the United States and the basic economic aspects that influence the industry.

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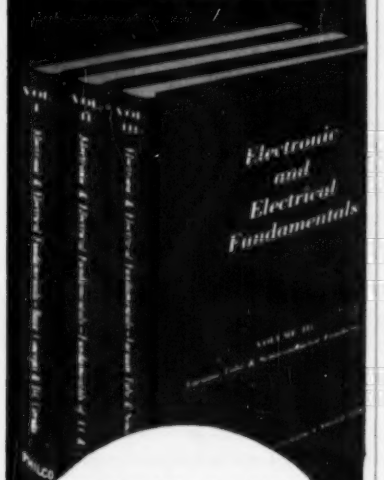

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Written in lively style by Delbert K. Byrn, editor of the Vocational Guidance Quarterly, the booklet shows young people how the ideas they now have and the courses they are now studying relate to the work they will do throughout their lives. Single copy price is $0.30. Write to the National Vocational Guidance Association, Inc., 1605 New Hampshire Ave., N.W., Washington 9, D.C.

How to Work with Plexiglas is a 20-page booklet giving detailed information on machining, forming, finishing, and joining of plastic sheets and other acrylic shapes. Published by the Cadillac Plastic & Chemical Company, the booklet illustrates and describes the procedures in detail. Copies are available from the company at 15111 Second Ave., Detroit 3, Mich.

Shellac—How to Use It is a 17-page pamphlet containing information about the use of shellac. The use of shellac as a base and as a finish coat is discussed and there is a section on colored and pigmented shellac. Copies may be obtained by writing to Shellac Information Bureau, American Bleached Shellac Mfg. Assoc. Inc., 51 Pine St., New York 5, N. Y.

Aircosil Silver Brazing Alloy Manual is a 24-page revised and expanded manual discussing brazing procedures, problems, and solutions recently released by the Air Reduction Sales Company. All Aircosil silver brazing alloys are thoroughly discussed and convenient diagrams aid in selecting the proper alloy to meet particular situations. To receive a copy write to the company at 150 East 42nd St., New York 17, N.Y.

Printing and Publishing Industry National Scholarship Program is a 15-page pamphlet describing the National Scholarship Trust Fund of the Education Council of the Graphic Arts Industry. The program is for high-school graduates and seniors interested in careers in any area of the printing and publishing industry. To receive the free bulletin write to the council at 5728 Conn. Ave., N.W., Washington 15, D.C.

Plastics as an Engineering Career is an eight-page brochure outlining the career opportunities in the plastics industry. The brochure describes the training of a plastics engineer and supplies information on the background and development of the industry. Free copies are available from the Society of Plastics Engineers, 65 Prospect St., Stamford, Conn.

Facts You Should Know About Agricultural Education in the Public Schools is a 11-page pamphlet telling the story of agricultural education today. Single copy price, $.10; 10 or more copies, $.06 each. Order from the American Vocational Association, Inc., 1010 Vermont Ave., N.W., Washington 5, D.C.

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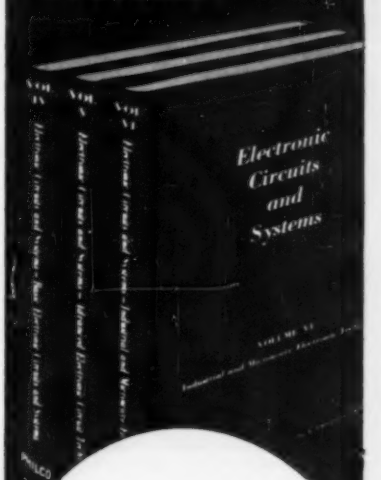

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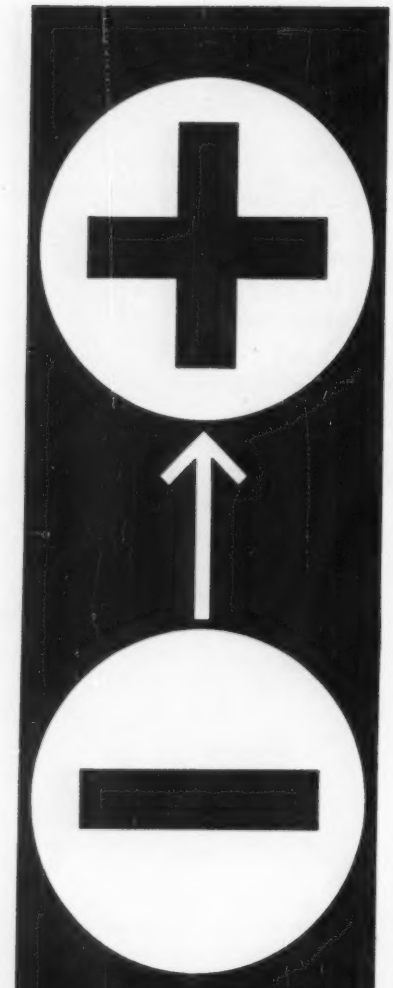

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Design . . . . . *from page 12*

these problems involve materials, processes, structures, mechanisms, circuits, systems, and such technical components, good design becomes good usage of the same. Effective function becomes one specific measure because technology is built on that kind of excellence.

Because of the concern for the fullest development of the student with his natural capacity for thinking, imagining, creating, and constructing, a second measure is that of uniqueness of solution. If he has his own set of unique capacities, and I think he does, he is capable of uniqueness. His solutions, therefore, should reflect this essence of one-of-a-kindness. Here is freedom of expression along with the responsibility for expressing. Emphasis on uniqueness can make industrial arts itself unique as a course of instruction. This is a truly significant value which it would be well for us to develop and to then advertise. We have long talked of industrial arts as concerned with individualism through individual instruction. But this can produce sameness as well as uniqueness. As it is, most of our courses seem geared to producing sameness.

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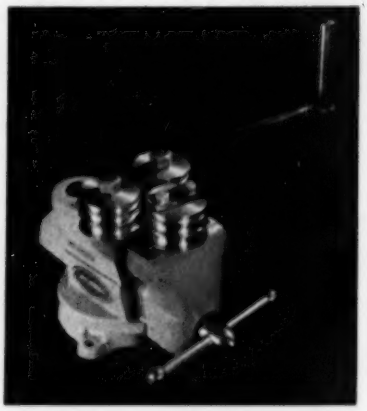

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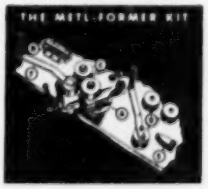

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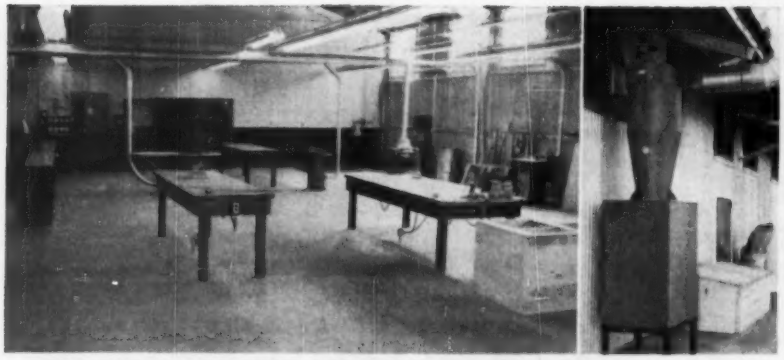

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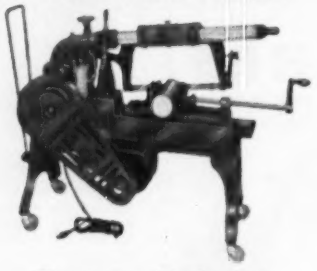

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Diamond Dust

Abrasive comments from that doughty Scot, Tom Diamond, former head, Department of Vocational Education, University of Michigan, Ann Arbor.

Declare a Truce

TEACHERS *A* and *B* teach in adjacent rooms, and both are teaching mechanical drawing. Notwithstanding this close relationship, it is known throughout the school that each is of the opinion that the other lacks most of the characteristics of a gentleman. And each feels quite sure that the general quality of teaching prevailing in the drafting department would be improved if the other could be induced to resign.

A takes a dim view of the teaching ability of *B*, who has the beginning courses in drafting, and is convinced that the pupils who come to his advanced classes are not prepared for the more advanced phases of the subject he is expected to teach. He finds that *B* has neglected many of the fundamental principles of drafting and has attempted to have his beginners solve some of the problems that rightfully belong in the more advanced section. How *B* feels about *A* is hard to describe, but it is just as uncomplimentary. Because of this lack of mutual respect, no effort has been made to harmonize the two divisions of the subject.

On inquiring into the situation, it is found that *B* believes that it is his responsibility to carry his pupils as far into the subject as possible, and that the rudiments, which he is supposed to teach, are so elementary that it would be a waste for the pupils to spend much time on them. Apparently *B* does not realize that when a pupil enters an advanced class in drafting he should have acquired reasonable skill in the use of drafting instruments, have a thorough grasp of the principles of projection, be able to do acceptable lettering, and have become familiar with the language of lines.

The acquisition of this skill and knowledge involves drill, and more drill, if the pupil hopes to apply them effectively to more advanced work. The pianist and the typist spend many hours on drill before they attempt to produce finished work, and when they are confronted with the problem of playing a tune or typing a brief they apply automatically the skills they have gained

through practice. The same should be true for the beginning draftsman before he enters an advanced class. The form in which the drill is provided matters little. What does matter is that it is included in the experience of every beginning pupil, and it is important enough to occupy the full time of a beginning class.

The private war being conducted by *A* and *B* tends to produce dissatisfaction on the part of the pupils when they enter an advanced class. They are compelled to continue their practice and, in many cases, they are required to repeat much of what teacher *B* had them do in the elementary class.

While the attitude prevailing between the two teachers might make it difficult, all of this suggests that *A* and *B* should cooperate in determining what each should cover, and should adhere to the agreement reached. If their personal jealousies make this impossible, it would seem appropriate for the supervisor to outline specifically what he expects each teacher to cover and use his authority to compel them to conform to the program he has outlined.

There is an important place in the scheme of things for each of these teachers, but the function of each should be clearly indicated. If this is done, the area in which *B* operates will be known, and *A* will know what he has a right to expect from the pupils who come to him for advanced work.

What has been said about drafting is equally true in regard to other areas of industrial-arts work. When the whole area of a subject is divided into appropriate sections, and the contents of each section is clearly indicated, the teacher can proceed with assurance to teach the parts for which he is responsible. He knows where to start and where to finish, and he knows definitely what his pupils have covered in the courses preceding the one he is expected to teach.

This may appear to some to be regimentation, but it tends to eliminate repetition as well as the confusion that is apt to arise in the minds of the pupils and in the minds of those who observe the classes at work. ★

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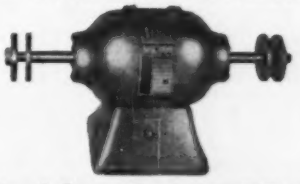

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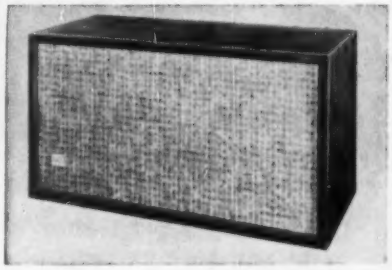
news from Industry

(Circle the numbers on the card in this issue to secure the items listed.)

Allied Markets New Knight Hi-Fi Speaker System Kit



Allied Radio Corporation recently announced a new kit for assembling a hi-fi speaker system. Designated the KN-3000A-K, the kit contains a 12" high compliance woofer, two patented Janszen electrostatic radiators, prewired power supply and filter network, acoustic lining, and all parts. The kit includes exactly the same components contained in the KN-3000-A factory-assembled unit.

Panels for assembling are of ¾" hardwood and have lock-miter joints; unfinished Korina veneering is used for external surfaces. Size, when assembled, is 14" x 26½" x 13".

For additional information write to the firm at 100 N. Western Ave., Chicago 80, Ill., mentioning SCHOOL SHOP; or *circle no. J-1 on the business-reply card.*

I. O. Johansson Company Announces New Heavy-Duty Radial Drilling Machine

A precision radial drilling machine designed to fill the gap between sensitive upright drills and large radial drills has been developed by the I. O. Johansson Company.

The drilling machine differs from conventional radial drills (where the arms move up and down) in that the drill column is supported in a housing that provides longer bearing support and inherent rigidity, the company reports. The radial arm (or ram) is available in 3' or 4' lengths.

For additional information write to the company, Skokie, Ill., mentioning SCHOOL SHOP; or *circle no. J-2 on the business-reply card.*

New "Draft-Pak" Unit Announced by O. A. Olsen Manufacturing Company

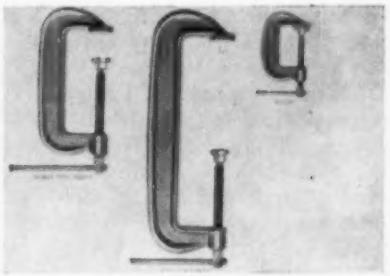
The "Ames Draft-Pak," a selfcontained portable drafting board with parallel blade and storage unit that offers a solution to situations where permanent table and/or storage facilities are limited, has recently been announced by the O. A. Olsen Manufacturing Company.

The unit is available in two sizes: 12" x 18", and 18" x 24" and is priced for individual student purchase, according to the company. A descriptive leaflet is available.

For more information write to the company, 712 Tenth St., Ames, Iowa, mentioning SCHOOL SHOP; or *circle no. J-3 on the business-reply card.*

Proto Tool Company Markets Series of General Service C-Clamps

A new series of general service C-clamps with a clamping capacity ranging from 2" to 12" are now being marketed by the Proto Tool Company.



Features of the new clamps include a short throat depth and extra-heavy threads. They are forged and heat treated from selected steels, the company states.

Each clamp is equipped with a patented Perma-Pad which permits a firm seat and furnishes extremely high holding power, the

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company claims. The clamps have a light oil finish and an adjustable T-handle.

For more information, write to the company, 2209 Santa Fe Ave., Los Angeles 54, Calif., mentioning SCHOOL SHOP; or *circle no. J-4 on the business-reply card.*

New Handy Hangers Added to Spa-Fla Welding Screens by Frommelt Industries

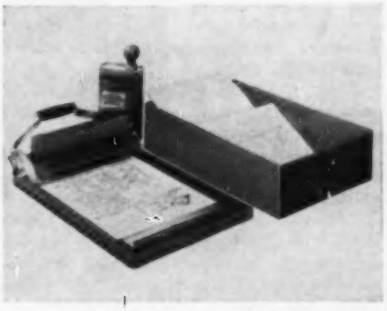
To increase the flexibility and versatility of the Spa-Fla wrap-around welding screens, Frommelt Industris, Incorporated, has added carrying handles which double as convenient loops for hanging the screens.

The screens are available in seven standard sizes ranging from 18" x 36" to 72" x 108" and are easily transported by welding cart or by hand, the firm states.

For additional information, write to the firm, 2929 N. Main Rd., Rockford, Ill., mentioning SCHOOL SHOP; or *circle no. J-5 on the business-reply card.*

Chalkboard T-Square and Portable Spirit Duplicator Offered by Master Addresser

The Master Addresser Company recently placed a movable, track-mounted chalkboard T-square, and a portable spirit duplicator on the market.



The chalkboard T-square is designed for quickly making neat, accurate, chalkboard drawings. It can be permanently mounted to any chalkboard in a matter of minutes and is adjustable to any angle, according to the company.

The portable spirit duplicator employs the same process as larger, more expensive duplicators. Impression paper is moistened with fluid which picks up carbon from the master. The master can be prepared by typing or by writing with a ball-point pen. The duplicator is available in two sizes, No. 150 letter size, and No. 151 legal size, equipped with carrying cases, the company reports.

For further information about these items, write to the firm, 6500 West Lake St., Minneapolis 26, Minn., mentioning SCHOOL SHOP; or *circle no. J-6 on the business-reply card.*

Dewalt, Incorporated, Expands Woodworking Tool Line

Dewalt, Incorporated, has announced it has obtained from the Atlas Press Company all designs, tools, jigs, and fixtures of certain stationary woodworking tools which were formerly a part of the Atlas line. Atlas will continue to make and market its line of stationary metal-working tools.

The agreement will become effective June 30, 1961. Expansion of manufacturing facili-

Famous Harco LIFT-LOK Chairs and Stools

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Over 25 styles and sizes of chairs and stools available. Equipped with the famous "Lift-Lok" mechanism.

S1824

MATCHING CHAIRS AND STOOLS FOR ALL HARCO EQUIPMENT

The all NEW exclusive "Lift-Lok" adjustment automatically adjusts the seat for persons of all heights. From its lowest position to the desired height simply lift up seat and seat will automatically lock.

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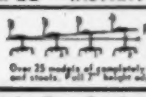

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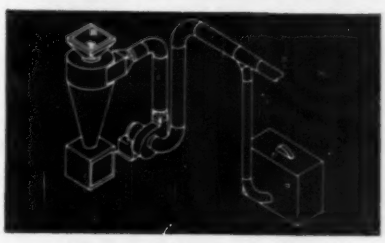

Keep Shop Clean, Students Safe

Get rid of dangerous dust and shavings . . . without time-consuming clean-up problems. New National System collects all wood shavings and dust. Powerful blower and self-cleaning wheel convey them to Cyclone Collector for easy clean out. Clean, filtered air then returns to shop with no heat loss.

National Systems engineers design custom installation for your shop—FREE upon receipt of sketch showing machine location, blower location preferred, beam location and height including general dimensions. Send inquiries to address below. Your questions will receive prompt, personal attention . . . no obligation on your part.

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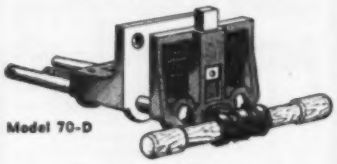

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ties is underway, and after a period of engineering, redesign, and plant tooling, Dewalt states it will introduce a broadened and diversified line of woodworking tools.

Two New Crucible Combinations Now Available for Johnson's 510 Furnace

The Johnson Gas Appliance Company recently announced that in addition to the standard No. 10 crucible for their No. 510 furnace, they are now stocking a No. 16 crucible and a No. 10 bottom-pour type crucible.

The company also has developed a new safety-pilot system that is for use with their No. 120 heat-treating furnace.

The new pilot system will eliminate backfires when lighting and will automatically shut off the gas if the flame goes out, the company claims.

For more information, write to the company, 584 E. Ave. N.W., Cedar Rapids, Iowa, mentioning SCHOOL SHOP; or *circle no. J-7 on the business-reply card.*

New School Catalog and Improved Vises Announced by Wilton Tool

The Wilton Tool Manufacturing Company, Incorporated, recently announced publication of a new condensed school catalog, No. 740, as well as improvements to their woodworking vise line.

The catalog supplies illustrations, prices, and specifications of the vises for the school trade and introduces many new models.

One new feature of the woodworking vises is a lifetime-lubricated Oilite thrust bearing, the company reports. This Oilite bearing, made of sintered bronze, is oil impregnated under high pressure. Being selflubricated on both sides, it develops less friction and allows the operator to tighten the vise to exact pressure required, the company states. The company claims it is the first vise manufacturer to use this type bearing.

To receive the catalog or for more in-

Below is the answer key to the crossword puzzle that appears on page 21 of this issue.

ANSWER KEY

Across	Down
1. Magnetite	2. Al (aluminum)
7. Brass	3. North
10. OC (Cobalt)	4. To
12. Tem (temporary)	5. Iron
13. North	6. Repels
14. Heat	8. Steel
16. Fell	9. SE
17. All	11. Core
18. OS	14. Hard
20. Drive	15. Alnico
22. Rod	16. Field
23. AC	18. Ore
24. DC	19. Lose
25. Poles	21. Rap
26. End	27. DC
28. Air	
29. Cross	

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SIMPLE PRINTED CIRCUIT
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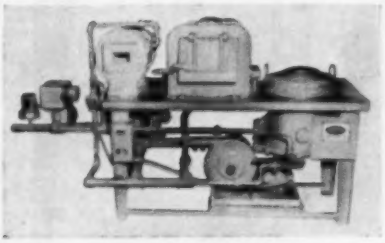
Salt Lake City 10, Utah
Frank Delvie, Manager

formation write to the firm at 9525 Irving Park Rd., Schiller Park, Ill., mentioning SCHOOL SHOP; *or circle no. J-8 on the business-reply card.*

Sunbeam Equipment Corporation Introduces Triple-Purpose, Heat-Treating Furnace



The Sunbeam Equipment Corporation recently introduced a triple-purpose, heat-treating furnace unit consisting of a pot furnace, an oven, and a forge. It is available in five standard sizes for gas-fired heating.

Practically every heat-treating operation can be accomplished with the new Model TP-D, and its versatility and compact design make it especially adaptable for use in small shops and schools, the firm reports.

For more information write to the firm at 168 Mercer St., Meadville, Pa., mentioning SCHOOL SHOP; or *circle no. J-9 on the business-reply card.*

New Literature:

Compressors, Pumps, and Hi-Pressure Washers is a new 16-page catalog listing with specifications of the complete line of Champion air compressors, compressor pumps, and high-pressure washers. Information is included to guide selection of air compressors and accessories.

To receive the catalog write to the Champion Pneumatic Machinery Co., Princeton, Ill., mentioning SCHOOL SHOP; or *circle no. J-10 on the business-reply card.*

128 Time Savers for Tool Makers is a 63-page brochure issued by Montgomery & Co., Inc., listing drilling, grinding, lathe, milling, punch-press, sawing, shaping, welding, sheetmetal, and die handling equipment. For a copy, write the company, 411a Morris Ave., Springfield 2, N. J., mentioning SCHOOL SHOP; or *circle no. J-11 on the business-reply card.*

Washington . . . . *from page 48*

dustrial education at the junior-high and senior-high-school levels. Tens of thousands of students have participated in the past, and the Association will offer some 1295 prizes totaling about $35,000 this year. Judging will be conducted on local and regional levels, with about 150 projects selected for a national competition here in Washington.

The announcement of the Ford grant came from AIAA President Ivan Hostetler, who is head of industrial-arts education at North Carolina

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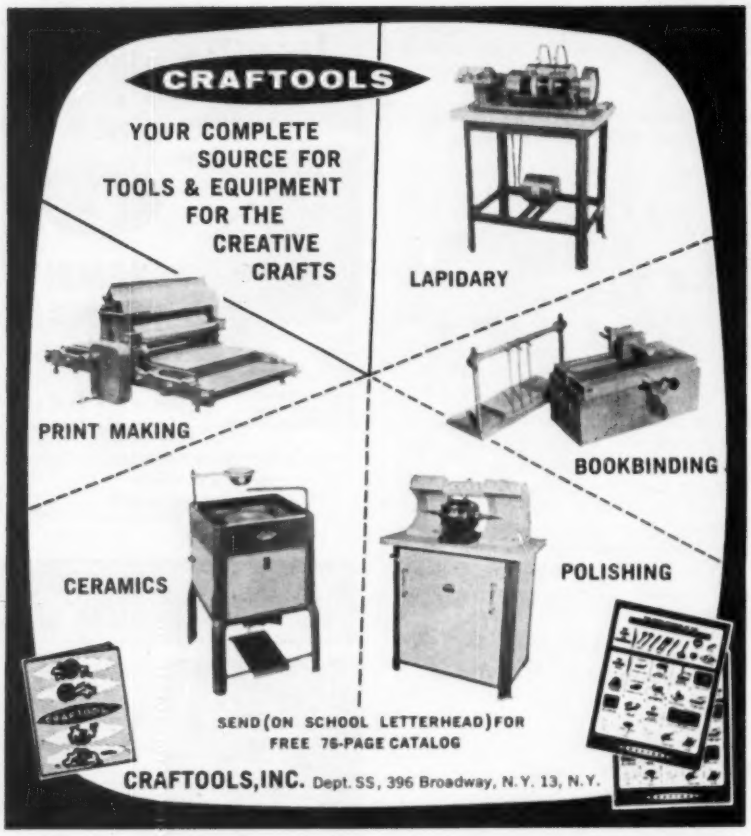

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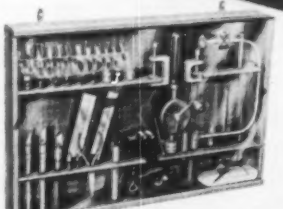

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State College of Agriculture and Engineering. He said:

"The AIAA decision to conduct its own Industrial Arts Awards Program was made because our Association recognizes that such programs are best operated by educational organizations and by experts in the field of education."

The AIAA, a department of the National Education Association, recently stepped up its activities by appointing its first full-time executive secretary, Kenneth E. Dawson. More information about the Awards may be obtained from him at the Association's offices, 1201 16th Street NW, Washington 6, D. C.

Pick-Up for Drop-Outs—A new and unusual vocational-education program to give on-the-job training to youths who have dropped out of high school as well as to those who are potential drop-outs will be tried out by the public schools of the Nation's Capital this fall.

As outlined by District of Columbia school officials, the program will encompass training in custodial and domestic, warehouse and cafeteria work, in baby sitting and hospital aid. There will be workshops to train "helpers" in the trades of shoe repairing, printing, carpentry, and electricity.

School work will be divided between the job training and an intensive remedial program in English, mathematics, and citizenship courses. Pupils will attend classes in the mornings and work in shops in the afternoons.

School officials stress that the program should not present youngsters with "blind-alleys" in low-skill jobs. Its purpose, they say, is to keep students from leaving high school with no job skills at all.

Once a youngster is placed in a job, counselors are expected to encourage him to complete his education in night school or day school on a co-operative work basis.

Using existing shop facilities, the program will not cost very much, and educators hope it will demonstrate results which warrant its continuation beyond the planned one-semester try-out period.

For Economic Health—Vocational and technical education do not cost—they pay. That is the conclusion of an eight-page brochure on "Relation of Vocational and Practical Arts Education to Economic Well-Being" just

issued by the Public Information Committee of the American Vocational Association.

The booklet, latest in the AVA's "Facts You Should Know" series, makes a persuasive case for the crucial role of vocational education in the economy. It cites the contributions practical-arts schooling makes to efficient production, intelligent consumption, and enjoyable use of leisure time.

Information on 10 countries is offered to demonstrate that "any nation which really wants to increase its wealth and raise the living standard of its people must expand and improve its facilities for education and training in the productive enterprises.

"In short, it must develop and maintain sound programs of vocational and technical education. The neglect of these means poverty and mediocrity as a nation."

Copies of the pamphlet are available at $6 per hundred or 10 cents per copy from the AVA, 1010 Vermont Ave. NW, Washington 5, D. C. ★

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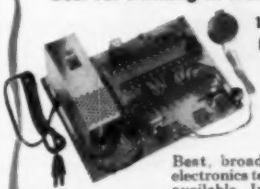

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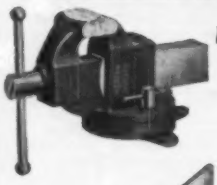

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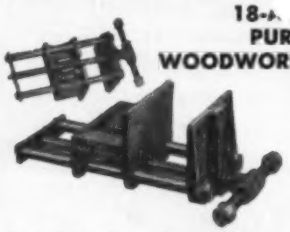

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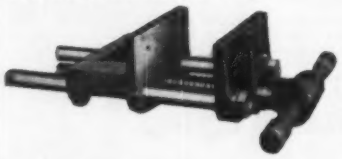

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by Edgar Hill

The Commissioner Speaks Out — United States Commissioner of Education Sterling M. McMurrin gave high priority to vocational education in his first official statement just an hour after he was sworn in as the Nation's top school officer.

"I believe that increased emphasis on vocational education is an urgent national need," Dr. McMurrin told reporters at his first press conference.

"More attention must be given to the education of those high-school graduates who can best fulfill their own and the national interest through vocational and technological pursuits."

Dr. McMurrin, former philosophy professor and academic vice-president of the University of Utah, called for "a comprehensive study of federal programs affecting education at all levels."

The Administration is already pledged to include in such a study a long hard look at federal efforts to promote vocational education. Educators and their associations are interested, too, and all these efforts are expected to result in some new legislation next year.

In other comments, Dr. McMurrin urged the "encouragement of quality and rigor in teaching and in what is taught," and suggested that the schools have been lax in making demands on students.

For the Office of Education, which he heads, he proposed "a more intensive development . . . as a national forum for the cultivation of ideas on education by outstanding minds from all disciplines, academic and non-academic."

Dr. McMurrin said he will work for closer relations between the Office of Education and state departments of education, for strengthening of the Office as a research center and as a "dissemination center for accurate, up-to-date information on education."

Equal Opportunity — Elsewhere on the New Frontier, Vice-President Lyndon B. Johnson urged that steps be taken to eliminate racial and other discrimination in apprenticeship training programs across the country.

The Vice-President wrote to Secretary of Labor Arthur J. Goldberg asking for recommendations on how to eliminate bias in apprentice programs. There have been complaints that some unions, particularly in the skilled crafts fields, bar Negroes from employment by denying them the right to become apprentices.

Johnson sent the letter as chairman of President's Kennedy's Committee on Equal Employment Opportunity, set up by an executive order this spring. Secretary Goldberg is vice-chairman.

The Vice-President said the Committee should not only act against discrimination in government employment and on government contracts, but should also meet its "positive obligation of seeking ways and means of promoting equal job opportunities."

"It is apparent," he added, "that one of the great barriers to equal employment opportunity in this country lies in the lack of equal availability of training for skilled trades and crafts. Men and women cannot have access to jobs unless they also have access to the instruction which qualifies them for those jobs."

Johnson asked Goldberg to "prepare recommendations to be made at the first Committee meeting as to steps that could be taken to strengthen apprentice training programs in this country," adding:

"The recommendations, of course, should be directed particularly to the problem of eliminating job discrimination."

Under New Management — The widely-known Industrial Arts Awards program sponsored and conducted by the Ford Motor Company for the past 11 years will be operated under new auspices starting this year. The Company has made an $81,500 grant to the American Industrial Arts Association to support the competition for the next three years.

The Industrial Arts Awards are designed to encourage fine craftsmanship among students in trade and in-

(Continued on page 45)

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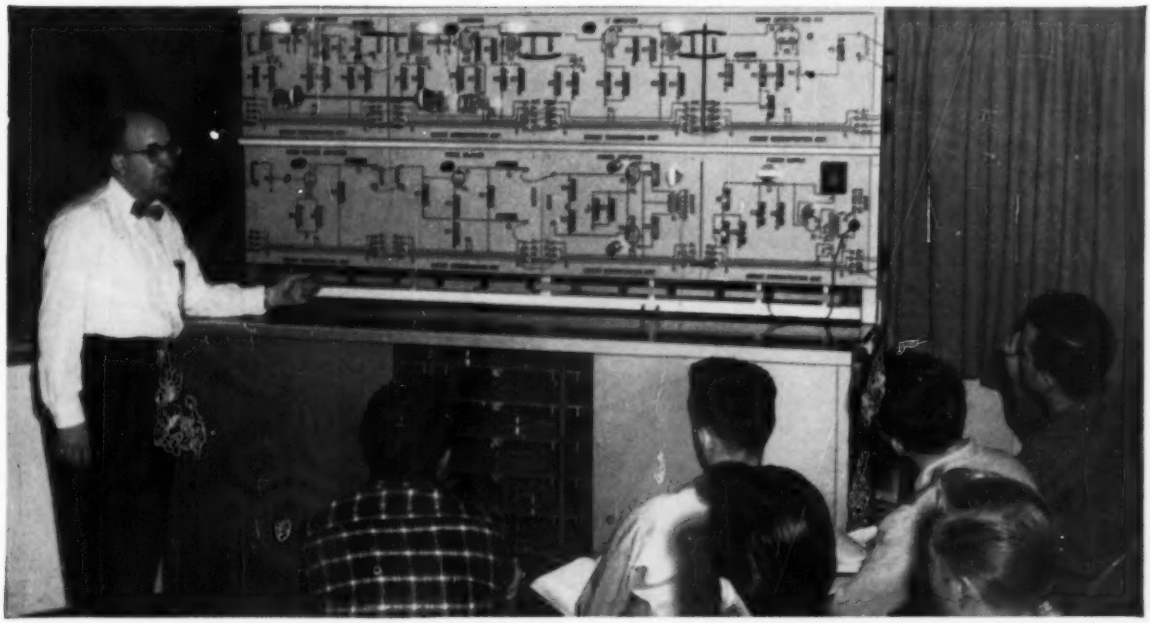

Bucks County Area Technical School, Fairless Hills, Pa., George H. Schaffer, Principal

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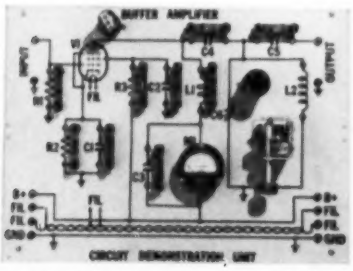

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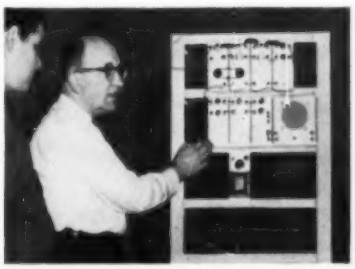

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